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The Outlook

Boosting Air Transport

BRITISH commercial aviation has had so many setbacks, financial and technical, that it is a pleasant change to be able to record a progressive step which, through technical improvement, will have a considerable effect on financial results.

The Avro Tudor 4 has been granted a full certificate of airworthiness at a new maximum all-up weight of 82,000lb instead of the previous 80,000lb. That may not appear at first sight to be a very significant percentage increase, but so narrow is the margin in civil aviation between profit and loss that in this case it means that the British South American Airways Corporation will be able to carry the full complement of 32 passengers plus a certain amount of freight instead of the 25 passengers to which it was previously limited on the East-West flight via Keflavik and Gander.

It will be recollected that after the disappearance of *Star Tiger* last January on a flight from the Azores to Bermuda, the Tudor 4 was grounded. Later the Ministry of Civil Aviation decreed that the type might be used as a freighter, and a few weeks after that, permission was given for it to be used again for carrying passengers, but not on the Azores-Bermuda route until trials of consumption and range had been made. B.S.A.A. then began to operate the northern route via Iceland and Newfoundland, but with the reduced passenger load of 25 on the westbound flights.

In the meantime the firms concerned have not been idle, and performance trials were made at Boscombe Down, the official testing establishment, in the presence of observers from the Corporation and the Air Registration Board. Thus there should be no further argument about the capabilities of the Tudor 4, and to make absolutely sure that all circumstances were taken into account, further trials were made in tropical conditions at Nassau, at the new all-up weight of 82,000lb.

So far, B.S.A.A. will continue to operate the northern route westwards, but it does not appear too much to hope that in time the southern route may be reopened.

The extra power for take-off and climb, amounting to some 35 h.p. per engine, is due to an increase in boost of an actual 1½ pounds, the Merlin engine once again coming to the rescue with that little bit of extra which has characterized its history all through.

Crystal-Gazing

"SOMETIMES one thinks how relatively simple everything would now be if the gas turbine had not been thought of, but there never has been an easy way in aviation, and woebetide any country or individual who thinks to the contrary!" So said A. Cdre. Banks yesterday in his lecture to the Royal United Services Institution. The lecture was entitled "The Gas Turbine and its Place in Service Aviation," and the sentence quoted was not a denouncement of Sir Frank Whittle but an expression of sympathy with the air staffs of the world, whose task of forward planning, always a difficult one because the next war is never quite like the previous one, has been rendered even more difficult by the fact that the characteristics of the new type of power plant have altered the parameters which control the shape of future aircraft.

A. Cdre. Banks outlined to his audience the different classes of gas turbine; the turbo-jet, the turbo-prop and the ducted-fan, which is really a variant of the turbo-jet. He then examined the virtues and drawbacks of the classes, and of different types, coming to the conclusion that turbo-jet and turbo-prop forms will both be used. On the question of centrifugal or axial compressors, he expressed the view that the latter will be used for the very highest performance on account of its smaller diameter, and where fuel economy is of paramount importance because of its possibility of higher

pressure ratios and greater efficiency. He expressed some doubts as to whether the ducted fan will be used at all in the future, but if it is, it will be for the bomber rather than for the fighter.

Turning to the question of aircraft, A. Cdre. Banks doubted the use of the escort fighter, and thought the better solution might be the "parasite" fighter carried in an escort aircraft. His "crystal-gazing" led him to see the fighter of the future as a single-engined machine, with greatly increased thrust (5,000 lb to 10,000 lb in 2,000-lb stages) and much greater fuel economy due to improved aerodynamic design of the airframe.

Due to the fact that at first there will be no others available, A. Cdre. Banks thought that to begin with the jet-engined bomber will use the same power plants as those used in fighters, but that the bomber is likely to have a multiplicity of engines. This he did not regard as the ultimate aim, and within the next ten or fifteen years, jet engines intended for bombers would have to be specially developed to give much better fuel economy. To achieve a 20 per cent better consumption than obtained with present engines, the ducted fan *could* come into the picture for cruising speeds of 500 m.p.h., but for 600 m.p.h. he thought it would be necessary to resort to compounded jet engines, of fairly high pressure ratio, possibly with two compressors in series, on separate shafts.

The bomber of really long range is a special problem, and A. Cdre. Banks, after weighing-up the claims of the compound engine and the turbo-prop, expressed himself in favour of the latter, in spite of its slightly greater consumption (0.42 lb/s.h.p./hr. as against 0.38). His reason was that the turbo-prop will have a lower drag (small cooling requirements) and will cruise at a higher percentage of maximum power and speed.

There will not be universal agreement with A. Cdre. Banks about the tailless, which he thought unlikely to persist in the military sphere, except possibly for bombers, where the concentrated load might result in but small changes of the centre of gravity. Nor, we think, with his final conclusion that for British airframe designers to catch up with their American opposite numbers will take ten or fifteen years. That we believe to be an unduly pessimistic estimate.

Much will depend upon the degree of priority given to research and development.

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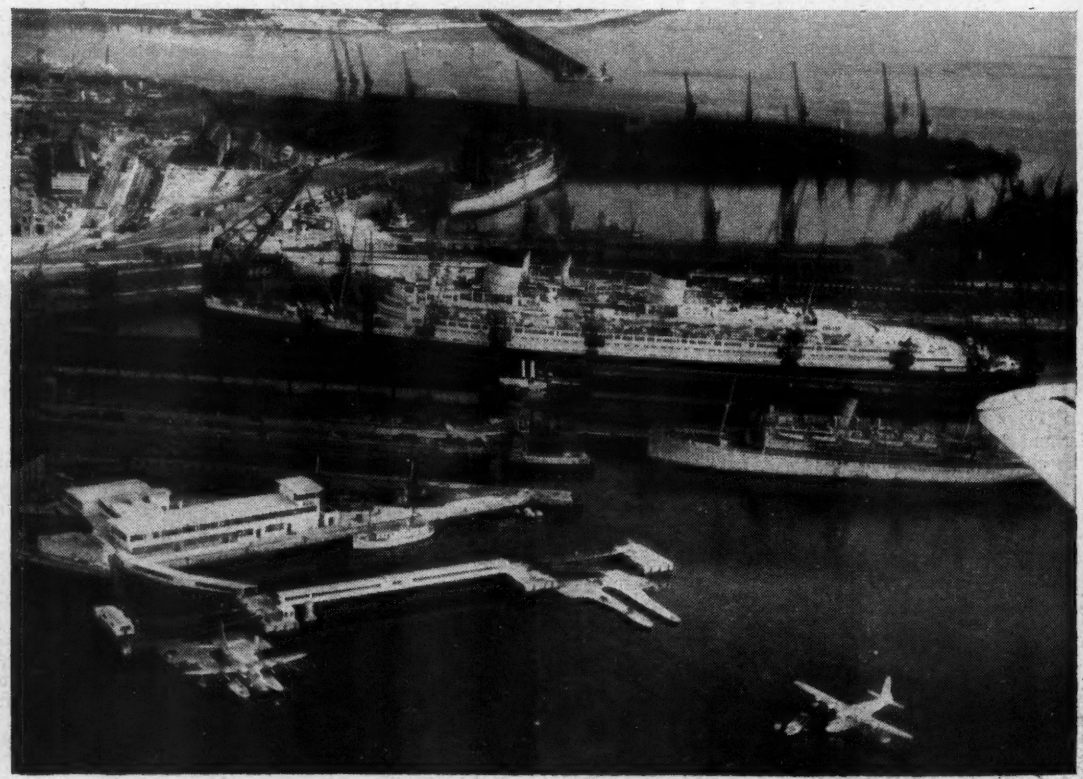
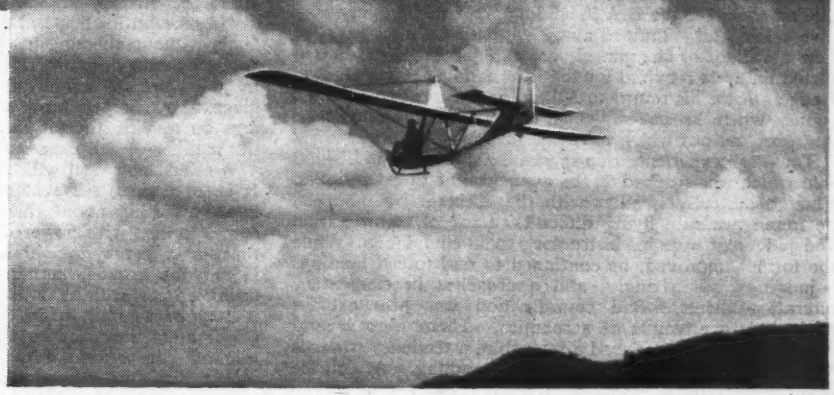


HOME FROM THE SEA: R.M.S. "Queen Elizabeth" looms majestically behind the B.O.A.C. marine terminal at Southampton. The Corporation's terminal building may be seen, and a Solent is moored at the landing stage. Escorted by a launch, a Hythe approaches its berth.

GLIDING and the ROYAL AIR FORCE

Its Value as Flying Training



By

F/L. H. NEUBROCH

A RECENT editorial in a journal devoted to soaring and gliding discusses the value of glider training to power flying and the flying services, and stresses the fact that a number of countries, among them France, Sweden, Argentina, Spain, and a number of those behind the Iron Curtain are subsidizing gliding and linking it with their military training schemes.

It is well known that the Germans used gliding to a very large extent in their pilot-training programme. Nearly all their service pilots had considerable experience on advanced sailplanes, and in the last year of the war there was a scheme afoot whereby students progressed directly from aerobatic gliders to jet-propelled fighters, without mastering the intermediate step of conventional, piston-engined aircraft. But the mere fact that our late enemy used gliding for the training of pilots is not in itself proof that this method is either necessary or desirable. Even German experts were not unanimous in their assessment of the value of glider training; its use can be explained historically, and as a matter of necessity.

After Lilienthal, Pilcher, the Wright brothers and other aeronautical pioneers, more than a decade elapsed before any further gliding flights were undertaken. During the 'twenties several schools established themselves in Germany and the popularity of the new sport spread throughout the country and, to a lesser extent, abroad. Though it is probably incorrect to say that it was always used to keep military aviation alive in a country which, by the Versailles treaty, was forbidden to have an air arm, the German gliding movement was nevertheless a willing tool in the hands of Goering when he re-established the Luftwaffe. Most German airmen had by then acquired considerable gliding experience; when they were given a free hand to organize a system of training, it is not surprising that they turned to the already well-established movement.

Launching a primary. This model is partially enclosed.

A point impressing itself favourably in the minds of the German air staff was the fact that glider training lent itself to the inculcation of a form of discipline fully in accordance with the Führerprinzip: while a large number of air-minded youngsters struggled to launch a glider, only a rigorously selected minority was allowed into the air. Speed of training was at first no consideration, and doctrinaire methods often prevailed against the demands of efficiency. Elementary training by means of bunje launches from a hill-top, for instance, was considered particularly valuable because of the *ésprit de corps* engendered when the glider was carried back to the top by hand; flying practice on level ground, where recovery of the machine would have presented fewer problems, would have been as efficient and speedier by far.

Making a Virtue of Necessity

A far cry indeed to the latter days of the war when everything, even the quality of the product, was subordinated to the demand for a specialized aircrew category: not the service pilot as we know him in the R.A.F., but a fanatic capable of flying a speedy but simple form of jet fighter such as the Volksjäger. Glider training was peculiarly well suited to this form of schooling which completely eliminated that portion of flying on which most air forces base nearly all their flying training. But the Germans were by then making a virtue of necessity: lack of petrol, lack of suitable aircraft and training fields immune from air attack left them little choice but to use gliders whose raw materials and production were simple and cheap, and which could be flown from almost any field anywhere in the country without drawing on Germany's rapidly diminishing petrol stocks.

Are we then to conclude that gliding is normally of no use to a flying service? We can seek an appreciation of the problem if we submit the claims of gliding enthusiasts to a critical investigation.

There is first the claim that gliding helps directly in the

Gliding and the Royal Air Force . . . . .

training of a service pilot. Unfortunately the number of service pilots who started their flying careers in the cockpit of gliders and sailplanes is too low to arrive at any definite conclusion. However, the case of a navigator who took up gliding at one of the R.A.F. gliding clubs in Germany may give a fair lead. Trained along standard German lines, he flew a variety of German gliders and sailplanes, and completed the tests required for the International Silver Gliding Badge. After his return to Britain he was sent on a pilot's course, where he was subjected to the usual thorough tests and observations which gave the following picture.

The pupil experienced no special difficulties up to his first solo which was reached in the average time of eight hours. Though perfectly familiar with the effect of the controls, he found accurate flying difficult. Lack of co-ordination and judgment were his instructor's main complaints. While the former improved, he continued to find forced landings —judging gliding angles and approaches in elementary aircraft—difficult. Bad co-ordination was also evident during early attempts at aerobatics. There were several comments on points of bad airmanship, a tendency towards "ham" flying, and poor engine handling. A definite improvement in all these points was, however, observed during service and advanced flying training.

Where Glider Training Fails

From this we may perhaps draw the following legitimate conclusions: granted that gliding experience gives the pupil a certain amount of air sense—a familiarity with the element with which he will henceforth be required to deal—the time spent to the first solo in a powered aircraft will be reduced only by a negligible amount. A haphazard, possibly "ham" way of handling the controls which may have been acquired while flying gliders will not easily be unlearnt, while the solo method of glider training is not conducive to accurate flying. We are all inclined to excuse our own faults even to the extent of ascribing an incorrectly banked turn to bumpy conditions or a faulty turn-and-bank indicator—but an instructor in the other seat will hardly take as lenient a view!

Lest this be taken merely for an argument in favour of two-seater glider instruction, it is necessary to stress the time factor. Eight to twelve hours are normally all the time required to attain solo standard in an elementary powered aircraft. This instruction can be given as efficiently and cheaply, but much quicker, than the equivalent training in either single- or two-seater gliders.

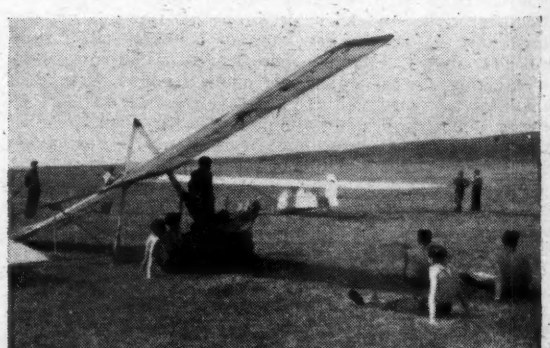
There is, however, one feature in favour of the solo glider method. Most pilots will remember, in their early flying days, an excited state of mind which I can only describe as the "solo complex." After a few initial trips with an instructor, the first solo flight assumes in the mind of the expectant pupil a significance out of all proportion to its real importance. This state of mind has often been responsible for delays in the pupil's progress. The solo method of glider training, with the pupil as the sole occupant of the machine right from the first gentle hop, completely eliminates the solo complex.

The difficulties experienced with forced landings on elementary types may cause some surprise, as gliders and sailplanes often have to land in confined space, particularly after cross-country flights. The glider pilot has, however, dive brakes at his disposal with which to control his gliding angle without affecting his gliding speed. Also, a shallow angle, as with a high-performance sailplane, may be easier to judge. It is significant that the pupil whose case is given above experienced no difficulties with forced landings on service aircraft in which he used flaps rather in the manner of sailplane spoilers.

We must now deal with the question of engine handling. It is, of course, self-evident that the glider pilot will not know anything about this all-important subject until he comes to deal with powered aircraft. When he does reach that stage, he may take his engine far too much for granted. It may be argued, perhaps rightly, that since his entire flying career will be intimately concerned with engines, it may be as well to fly with them right from the start. Jet fighters may not be affected by torque or swing on take-off (the reason why the German glider-to-jet, and rocket, training method was so effective) but as long as service pilots are required to fly all types of aircraft, the correct use and handling of engines cannot be taught too soon.

Summing-up the claim that gliding helps directly in the flying training of service pilots, it may be held that gliding gives a sense of familiarity with aircraft and their element, teaches the effect of controls, simple manœuvres and landings, but does not teach accurate flying, nor does it necessarily remove a tendency to be "ham-handed," or improve judgment.

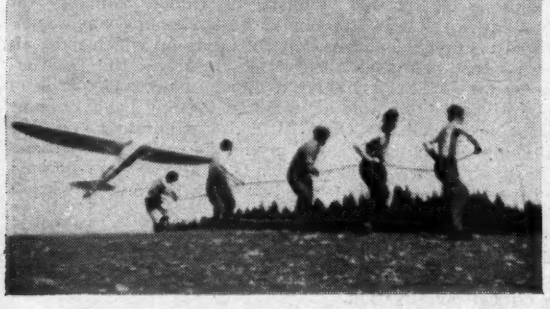
In the matter of meteorology and theory of flight, however, there is no doubt that the advocates of glider training are on much firmer ground. The importance of these two



Gliding trainees relax round a primary glider while watching a winch-launch.

subjects to the service pilot is recognized by the authorities, though they are probably not aware of the extent to which gliding and soaring may be used to teach them. Right through their training, all categories of aircrew are given an intensive though necessarily somewhat dry grounding in meteorology. They are taught to classify clouds, to beware of cumulonimbus, to draw the standard pressure distributions and standard fronts, and many other essential things. But there is unfortunately only a small minority to whom all these mean a great deal in practice—a strange contrast with even the newest gliding tyro bristling with meteorological information, from orographic lift to the standing wave! To the man who has sailed along a cold front or consulted a tephigram before circling serenely under cumulus, meteorology can never be just so much theory.

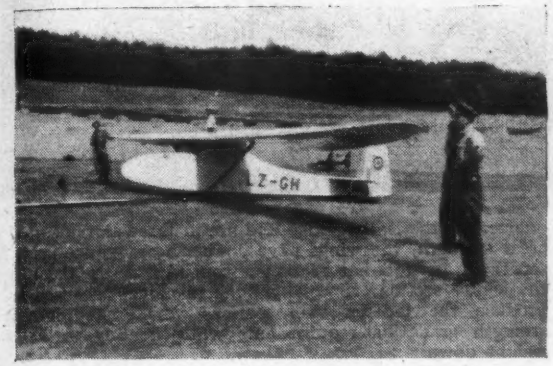
If the art of soaring is the application of meteorological conditions, it is just as much the application of pure prin-



Exertion—a five-man-power launch, using a "bungee" cable.

ciples of flight. A few minutes on the ridge, a short cross-country flight, and lift-drag ratios really mean something tangible; even those dreadful twins, Flying for Range and Flying for Endurance, which seem to cause trouble even to experienced pilots, lose their terror to the man who has achieved an infinitely large number of air-miles per gallon.

There are, furthermore, a variety of problems, ranging from the nature of eddy currents in the vicinity of the flight decks of aircraft carriers to the mysteries of cumulonimbus, which lend themselves particularly well to investigation by motorless planes. At least one member of the Central Forecasting Office at Dunstable has realized the value of sailplanes as an aid to weather research and has purchased his own private machine. The proceedings of the Royal Meteorological Society regularly report contributions from sailplane pilots which have proved of considerable interest. The advance of the science of aeronautics and many of its allied subjects, it is claimed, should, in the eyes of the



The Grunau Baby, in large-scale use at R.A.F. gliding clubs in Germany.

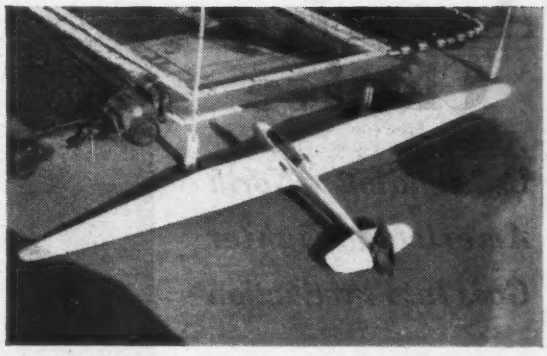
authorities, be a sufficiently weighty consideration in favour of supporting the gliding movement.

Lastly, but certainly not least in the order of importance sailplane enthusiasts point to the imponderables affecting service morale and prestige. In these matters it is impossible to estimate the exact value of a well-organized gliding movement run by the Service for the Service; nevertheless, this aspect should not be dismissed lightly.

It is in the nature of things that in a modern air force only a small proportion are actually engaged on flying duties. Progressive specialization inevitably brings with it a separation between the flying and the non-flying men, and even among aircrew there is sometimes a marked lack of understanding between members of different categories flying together, supposedly as a team.

Gliding clubs established at a number of centrally situated airfields would go a long way towards counteracting some of the effects of this tendency. The clerk, the cook, the medical orderly, the fitter, even the navigator or wireless operator who uses the facilities of a gliding club will soon gain a clear and valuable insight into the mind and work of a pilot; the pilot will be all the better for some rather unusual flying experience, and if he carries out his own inspections and helps with the repair and maintenance of club machines and with the running of the club generally, will arrive at a much better appreciation of the part played by all the ancillary trades which, together with the flying personnel, go to make up a modern air force. Good co-operation within the gliding club—and no club worth its salt can be run without that—would contribute towards a better spirit, and the effect on morale and efficiency throughout the Service would be considerable.

Teams have represented the Service in a variety of competitions, from rifle shooting to winter sports. Some of these have been extremely successful, and rightly enjoy high esteem and some support. Yet as far as gliding is concerned there is only the British Air Force of Occupation



A high-performance two-seater—the German Kranich sailplane.

which can be considered for the selection of a team capable of representing one of the world's great air forces in an international soaring contest such as was held in Switzerland this summer. This is not entirely due to the fact that gliding talent is not available in other commands, but to the strictly limited amount of German material which has been made available to the few Service gliding clubs in Germany. Yet there can be few finer examples of how much it is possible to achieve, in gliding as in other spheres, given a modicum of equipment, some good organization, and an unlimited supply of enthusiasm!

Adequate gliding facilities throughout the Service would lead to a great deal of competition between the various units. Standards of achievement would be raised, and more national and international soaring records could be attacked and quite probably broken. This, it is claimed, would serve to strengthen Service prestige—never an inconsiderable factor but more important to-day when it is necessary to attract the right type of air-minded man to the air force.

These then are the arguments advanced by those who would like the Service to take a more positive attitude towards gliding and soaring. There is, of course, any amount of room for discussing the best ways of establishing and encouraging a vigorous movement; suffice it to say that apart from a small measure of official support and consideration, most of the contributions in money and effort should be borne by enthusiasts and supporters within the Service.

A TOTAL of 112,836 glider launches have been made so far this year at R.A.F. Reserve Command Units.

At the 53 Glider Schools in the Command (including one in Northern Ireland) members of the A.T.C. who passed their glider test during the three months ended September numbered 612, making a total for the year of 1,537. The total of launches in this period was 41,250.

FUTURE OF GRANGEMOUTH

THE Air Ministry has notified the Grangemouth Town Council, through the Department of Health (Scotland), of its willingness to relinquish the Grangemouth airfield, which is required for an £11,000,000 industrial development scheme. The airfield is at present used as No. 13 Reserve Flying School, R.A.F.V.R., and, in announcing their decision to relinquish it, the Air Ministry add "The V.R. Flying School will carry on there either until an alternative airfield has been found or until building operations on or near the airfield make further flying unsafe."

It is understood that some time will elapse before building operations will encroach to any marked extent on the airfield, so that there is no immediate threat to the work of the school, which has now 40 aircrew in training and another 150 in various stages of entry. Efforts to transfer the school to the R.N.A.S. airfield at Abbotsinch or the civil airport at Renfrew having failed, another airfield is under consideration at the moment. The Flying School is associated with No. 101 Reserve Centre, R.A.F., Bishopbriggs, Glasgow, and there is a possibility of a town centre also opening up in Edinburgh.

American Choice

Outstanding North American Fighter Goes Into Production

"No hot-house flowers—but rugged operational aircraft." The North American F-86 and its four-jet bomber relative, the B-45. In production, both will have General Electric T.G.-190 turbojets of 5,000lb thrust. (Below) Take-off: an F-86 at Lambert St. Louis airport.

MANY of us in this country are apt to become a little confused by the multitude of military and research prototypes announced in America and by the mixture of official performance data and startling claims advanced by publicity departments and other sources. It is not even easy to connect the various XFs and FJs, their numbers, and the A, B and C marks, which follow the aircraft names with the companies producing them. One fighter which is now generally known, though perhaps not well enough, is the North American F-86, the official world speed record holder, which achieved an average speed of 670.981 m.p.h. with full military equipment—ready, in fact, to fight.

This machine comes from a distinguished stable and follows the wartime Mustang and post-war FJ-1 deck-landing fighter now in production for the U.S. Navy. A near relation is the shapely four-jet XB-45 bomber, also in production and capable of over 500 m.p.h.

The F-86 is no high-speed "Special," nor is it a one-off-prototype which will soon be forgotten. Nearly 700 have been ordered for the U.S. Air Force and the prototype, which first flew in October, 1947, has made over 250 flights. Since May of this year a General Electric J-47 (TG-190) power unit has been fitted, which delivers over 5,000lb thrust, and 550 of the total aircraft order will be F-86 As with this type of turbojet. The designation F-86C has been mentioned in connection with the final 120 aircraft in that order, with turbojets of still greater thrust. In the G.E.J-47 provision is made for water-injection which enables power to be stepped-up to about 6,000lb thrust in emergency.

Swept wings were an afterthought in the design and for the original straight wing a 35 deg angle was substituted while the first machine was under construction. The wings, of 37ft 1in span and carrying automatic leading-edge slats, have many interesting constructional features. The slats themselves occupy three-quarters of the leading edge and are in three sections. Of great strength, the wings have double heavy-gauge skins, separated by top hat sections, from tip to tip through the centre section. Special milling machines are used to produce the tapered skin sections which provide for strength gradation requirements while helping to keep weight down.

Like the Thunderjet, the F-86 rear fuselage detaches just aft of the wing trailing edge. Surface finish has been the subject of particular attention and the flush rivets, used throughout, are milled after insertion.

An interesting feature of the small-area swept tail surfaces is that tailplane incidence is adjustable through 11 deg. It is stated that this feature makes possible the use of smaller surfaces, resulting in unusually good flying characteristics at transonic speeds. Sections of the tail have been reinforced with steel to cope with the temperatures experienced at high Mach Numbers. Portions of the skin have reached 300 deg F. The pilot adjusts tailplane incidence through a button control on the stick.

Features of the F-86 concerned with the cockpit include an ejector seat and a curved glass canopy, eliminating refraction and glare. Later, windscreens will probably be of vee-form. Space has been found for full radio and radar navigational aids, and a refrigeration system has been fitted for pilot comfort at high speeds. Air brakes now fitted take the simple form of two bars which extend on each side of the fuselage.

Recently, in the American journal *Flying*, some remarks by the North American test pilot George Welch, and some additional details of the F-86 were published: Welch says "The plane's so clean you never have trouble. Reduce drag to a minimum and you don't have to worry about effects of compressibility shock waves." He added that the F-86 was the easiest fighter to fly; that it had a terrific rate of roll, and was

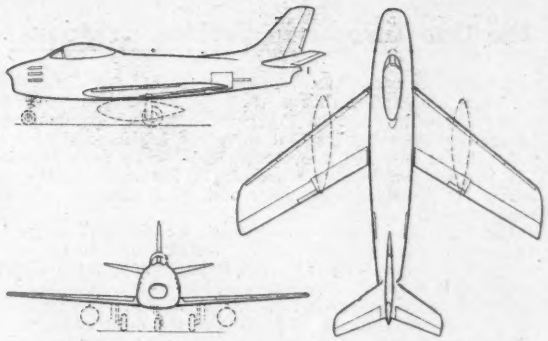
American Choice . . . . .

highly manœuvrable at high altitude. Spin recovery was "easy when pressure on the elevators was released." It appears that the take-off angle is a little startling. "It seems, at first, ' Welch reports, "as if the nose is pointed too high and you might stall. You soon get used to it, though."

Armament is said to include up to six 0.50-inch guns, rockets, or either light bombs or two 1,000-pounders.

Although official confirmation is lacking to date, it seems very probable that the F-86 has more than once been dived at a speed exceeding Mach 1. At least one British pilot has flown the F-86 at high speed.

Pending the release of full performance data it can be stated that maximum speed in service trim is at least 670 m.p.h.; service ceiling over 40,000ft; maximum range over 1,800 miles, and tactical radius 500 miles.



NORTH AMERICAN F-86: Span, 37 ft 1 in; length, 37 ft 6 in; height, 14 ft; and all-up weight, 13,715 lb.

The Gas Turbine in Service Aviation

Air Commodore Banks States His Opinions Before the R.U.S.I.

AT the outset of his lecture, *The Gas Turbine and its Place in Service Aviation*, before the Royal United Service Institution, on November 17th, A. Cdre. F R. Banks, C.B., O.B.E., notified his audience that he would take his courage in both hands; he would give his views on the influence the gas turbine would exert upon the thinking of those who had to plan ahead for our military well-being in the next 10 or 15 years. Much of the lecture was, in fact, conjectural, and much explanatory. Of special value in the latter connection was A. Cdre. Banks's concise description of the various forms of gas turbine.

It was supposed, he recalled, in the very early days of the gas turbine, that the engine would be tailored to fit a particular aircraft. The thought behind this was that the turbojet in its original (Whittle) form was so simple to make that it would be a comparatively easy matter to build an engine for each new aircraft. This idea has, however, been discarded for the simple reason that it is not practicable, being prohibitively expensive both in time and money.

Military aircraft of the future would all be "bulk limited" because of their speed, so that both the engine and the fuel carried must offer the smallest possible bulk to make way for military equipment and the various means (radar and the like) for using that equipment to the best advantage. The axial compressor helped in this direction, and although it was more sensitive to damage than the centrifugal type, and might drop slightly in efficiency during its working life (because of dirt and slight damage or erosion to its many blades), these disadvantages could not be over-riding where maximum performance was demanded and where, after all, the life of a first-line military aircraft was relatively short. Certainly this was the case in war, where performance was everything.

A.Cdre. F. R. Banks.

The lecturer did not think (and here he admitted treading on thin ice) that the jet fighter would be of much use as an escort to the airscrew-driven bomber or the jet bomber, because of the difficulty of carrying the extra fuel load. It seemed that it would be more practical to resort to a "parasite" machine which would be carried in an escort aircraft accompanying the bombers. This parasite might be propelled by a turbojet or liquid rocket motor. It might have to be jettisoned, or considered expendable, the pilot escaping by parachute, because the escort, or mother aircraft, might be involved in action and it would be impracticable to effect a "hook-on." The very fast jet bomber, flying at great altitudes, might have a fair chance of escaping attack from piloted aircraft, if not from guided missiles with proximity fuses. In any case, once it arrived over its target and discharged its bombs, it probably had a better chance than the escort fighter, which might still be retaining a large proportion of, if not all, its military load.

Further considering the turbojet fighter, A. Cdre. Banks said that it was still open to question whether or not a single- or twin-engined machine would be the final answer. This was a very important decision to make because it influenced future engine development. As he saw it, to get to a maximum operating height of, say, 45,000 feet, and maintain the highest possible speed, the all-up weight, frontal area and wetted surface must all be at the minimum possible, other things being equal. If this were the case, then the aircraft would probably have a single engine of high specific output, i.e., high thrust per square foot of engine frontal area, and high power/weight ratio. The Air Commodore agreed that this contradicted his previous thoughts and views of about two years ago.

The rate of increase in engine power would be largely determined by the advances made in practical aerodynamics, and the lecturer's guess was that there would be a steady upward trend from the present maximum of 5,000 lb thrust per engine to about 10,000 lb, in stages of approximately 2,000 lb, in the next ten years or so The specific consumption should be reduced to about 0.9 lb per pound of thrust within two or three years and, say, to 0.85 lb in five or seven years. This mainly applied to turbojets for fighters or interceptors. For the jet bomber fuel economy was more important and some increase in engine weight and mechanical complication would be justified if the bulk of fuel carried could be appreciably reduced.

Because the ducted-fan unit had not yet been tried in the air, and no aircraft had been specifically designed for it, its value remained largely conjectural.

Of the three practical methods of augmenting turbojet thrust (liquid injection, after-burning and rocket) A. Cdre. Banks preferred after-burning because it made use of the normal engine fuel and was more economical in fuel consumption than the other methods. About 2½ lb of fuel (in addition to that consumed by the engine) were used in after-burning for every one pound increase in thrust, whereas at least double this quantity was required for the same thrust increase in the case of other methods.

Reverting to the subject of jet bombers, the lecturer foresaw that, within the next 10 or 15 years, turbojets intended for these aircraft would be giving cruising consumptions, at operating altitude, at least 20 per cent better than now obtained. To achieve this, for cruising speeds of, say, 500 m.p.h., the ducted-fan unit might have some practical application, but later, at speeds of some 100 m.p.h. higher, it would probably be necessary to revert to a compounded jet engine of fairly high pressure ratio, i.e., with two compressors in series, on separate shafts. A compounded jet unit would eventually have to be designed to give a specific fuel consumption of not more than 0.8 lb per pound of thrust (static sea level) and, in its later development, 0.75 lb. Future jet bombers would probably carry a crew of two and would be equipped with every possible device for blind-flying and for searching or scanning.

Considering what he called "the really long-range bomber" and its power plant, A. Cdre. Banks said that at the moment there were two possible engines—the compounded piston engine and the propjet. He favoured the propjet because he was sure that one could be built which would give an

The Gas Turbine in Service Aviation . . . . .

equivalent cruising fuel consumption of the order of 0.42 lb/s.h.p./hr. Although the compounded piston engine would probably have a lower cruising fuel consumption (about 0.38 lb/b.h.p./hr.), it would be heavier and have a much higher installed drag because of cooling requirements. The propjet bomber would probably cruise at a higher percentage of its maximum power and speed than its piston-engined rival.

The problem of building an aircraft for a still-air range of 12,000 miles was still formidable. Calculations showed that for such a range, to fly at 40,000ft and 500 m.p.h., with a useful bomb load, the machine would be about twice the all-up weight of the Brabazon I (about 500,000 lb). This assumed an airscrew efficiency of plus 80 per cent, which might be difficult to attain. As a matter of interest, the Air Commodore recalled that, towards the end of the recent war, a power plant was considered for a reconnaissance aircraft of long duration (25 hours; 7,500-10,000 miles range). Calculations showed that there would be a difference of 60,000 lb in the all-up weight in favour of a compounded piston engine giving a specific cruising fuel consumption of 0.34 lb/b.h.p./hr., compared with 0.44 lb/b.h.p./hr. offered by a conventional piston engine.

A. Cdre. Banks did not think that the tailless aircraft would persist in the military sphere. One of the disadvantages he mentioned was that if the control surfaces were shot away or suffered battle damage, there was little hope of getting the aircraft safely back. The c of g limitations would prejudice modification. There was, however, one type of tailless aircraft which would undoubtedly have a place in military aviation because of the really high performance it offered —the Delta wing. This would not, however, be developed for service use within the next 15 years.

As might have been expected, the lecturer had some interesting observations to make on the subject of fuel. At the moment, kerosene (paraffin) was used in gas turbines, but turbojets were usually cleared for emergency operation on normal 100-130 grade leaded fuel. Turbojets for the U.S. Navy were tested on kerosene, but used aviation gasoline on shore and in carriers because of the problems involved in storing two different fuels. It was more than doubtful whether kerosene would be available in time of war. Since gasoline remained the product in greatest demand from crude oil, and because the refining charging stock to make gasoline comprised a large proportion of the "middle of the barrel" products of the crude (which included kerosene), it was not difficult to see that anything taken from "the middle of the barrel" would tend to reduce gasoline supplies. The demands of surface transport would, said A. Cdre. Banks, still be greater in war than those of aviation. If he remembered rightly, twelve U.S. gallons of petroleum products were used on the ground in the recent war for one U.S. gallon used in the air. Although the turbine would undoubtedly be developed to use higher flash point fuels, which would reduce the fire hazard, military demands for gas turbine fuels in time of war would be so great that it would not be possible to supply these special fuels.

Another three to five years would be needed for proper anti-icing systems to be evolved which could be incorporated as an integral part of the engine.

In his closing remarks the lecturer observed that it looked as if future advances in aerodynamics, and consequently in aircraft design, would eventually bring us to a stage where all the world's first-class military aircraft would have very much the same performance, particularly as the gas turbine could provide all the power needed. This state, however, would never come about in our lifetime. Britain should be able to retain indefinitely her lead in the gas turbine field. The U.S.A. was certainly ahead at present in aerodynamic progress, and it would be difficult for us to level up with them in this respect.

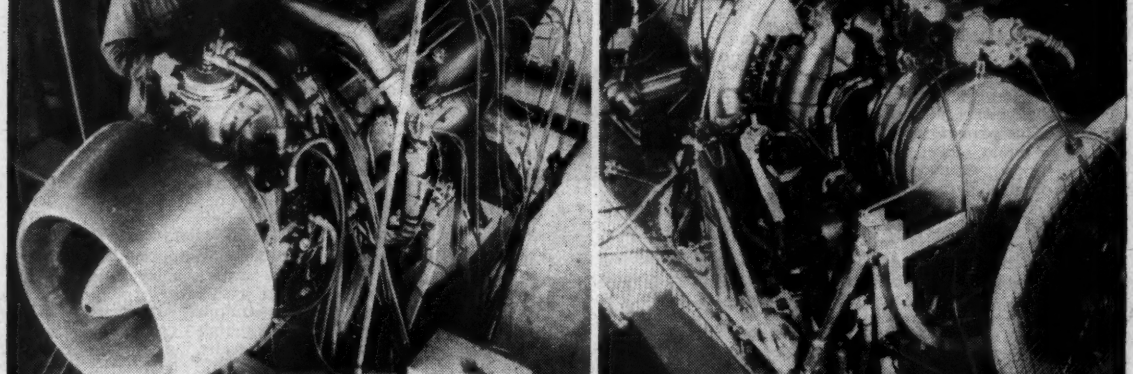
"But this country," concluded the lecturer, "has always been blessed with practical thinkers and men of imagination, so there is every reason to hope that we will not be too far behind, if we are behind at all, in ten or fifteen years' time."

TWO SWEDISH TURBOJETS

PRELIMINARY information concerning two quite different Swedish gas turbine power units was released for the first time last week, although the existence of one of them was mentioned in our article dealing with the work of the manufacturing company earlier in the year. This company, the Svenska Flygmotor AB of Trollhättan, have produced and are testing a development unit to the design of Mr. Alf Lysholm and Mr. G. A. Dalhammar. It has a two-stage centrifugal compressor and four-stage turbine, the layout being somewhat similar to that illustrated on page 217 of the August 19th issue of *Flight*. This unit is in the 2,000-3,000 lb thrust class. It will be remembered that S.F.A. are preparing to build D.H. Goblins under licence and later on may also produce Ghosts.

An axial-flow design, the work of designers Curt Nicolin and Eric Ostmar, has been built by Svenska Turbinfabriks AB Ljungström of Finspang. This is on test and the only data released is that it has shown an efficiency of 87 per cent, and has been tested at a working pressure of 3.2 atmospheres.

The only other turbine running with two-stage centrifugal compressor is the Rolls-Royce Dart turboprop. The SFA design, however, has reverse-flow annular combustion, the chamber being arranged around the multi-stage turbine.



Newly announced turbojets from Sweden here illustrated for the first time are (left) the STAL Sweden's first axial-flow straight-through design, and (right) the SFA two-stage centrifugal type. Both are under active development.

CIVIL AVIATION NEWS

More Power for Tudors: I.C.A.O. Vacancies: Radar Meteorology.

FUTURE ASCENDANCY: An artist's impression of the Bristol 175, twenty-five of which it is announced that B.O.A.C. are proposing to order. Their long-term plans envisage the operation of these types in 1953-54

BRISTOL 175s PROPOSED FOR B.O.A.C.

PROPOSALS that a production order should be placed for 25 Bristol 175 aircraft have been announced by B.O.A.C. In its latest form the Bristol 175 represents a great advance on the M.R.E. specification evolved by B.O.A.C. in 1947. The aircraft is planned so that Bristol Centaurus piston engines or Bristol Proteus airscrew turbines may be fitted, the design allowing for easy interchangeability. Comparison with the performance of the Lockheed Constellation indicates that if fitted with the Centaurus piston engines the Bristol 175 would have performance superior to that of this American aircraft. When fitted with the Proteus airscrew turbines the cruising speed of the Bristol 175 is expected to be at least 75 m.p.h. higher than that of the Constellation. Advantages of the Proteus airscrew turbine would be the great increase in passenger comfort due to the reduction of noise and vibration and, since the Proteus operates on kerosene rather than aviation petrol, increased safety would result from a reduction of fire hazard. Cabin lay-outs now under consideration include a 38-passenger sleeper version for use on the longest routes and a 60-passenger version which would provide a standard of comfort comparable with the Constellation. As an alternative, the Bristol 175 could be adapted to carry over 70 passengers, though the conditions would be more austere and these aircraft might be used to fly passengers at reduced fares. According to the present proposals the aircraft is scheduled to be in operation on the medium range Empire routes in 1953-54. In making this decision B.O.A.C. have been anxious to take full advantage, in a practical form, of the lead which this country has over other countries in the development of airscrew turbines for aircraft.

STRATOCRUISER ALL-UP WEIGHT

CERTIFICATION of the Boeing Stratocruiser by the U.S. Civil Aeronautics Administration for a gross weight of 142,500 lb has been announced by the Boeing Airplane Company. During certification tests and manufacturer's trials over 700 hours have been flown. The new gross weight is 7,500 lb more than the figure originally guaranteed and the plan has been approved for a design useful load of over 30 tons. The cabin air conditioning system has made possible an approved altitude of 25,000ft, at which height cabin pressure is equal to that at an altitude of 5,500ft. B.O.A.C., S.A.S., and four U.S. airlines have ordered Stratocruisers.

MERSEY ACCIDENT

ON the night of November 11th a D.H. Rapide, flying from Dublin to the Isle of Man, was, on account of fog, diverted to Speke after circling Ronaldsway for 40 minutes. When approaching Speke from the Mersey the aircraft's fuel became exhausted and it fell into the Mersey causing a loss of seven lives. The pilot was Capt. J. C. Higgins, who had very extensive experience of this route, having flown Rapides to and from the Isle of Man for some 14 years. Capt. Higgins previously flew with B.E.A. and it was at the end of May this year that he terminated his service with the Corporation to start Mannin Airways, owners of the aircraft, of which he was managing director. Of the eight occupants of the aircraft, six passengers and a crew of two, only one passenger survived.

B.E.A. GROUND ENGINEERS STRIKE

ON the grounds that an incentive bonus scheme would be unfair to them, some B.E.A. ground engineers commenced an unofficial strike on Sunday, November 7th. Plans to introduce such a scheme were first discussed by representatives of all concerned early in 1947, and after making a careful review of the various other methods of increasing efficiency the decision was subsequently taken to introduce the premium bonus scheme initially in the Certificate of Airworthiness hangar at Northolt. It was felt that as workers of many aircraft constructors and some maintenance specialists were paid on the premium bonus system, the work of B.E.A. ground maintenance could well be put on a similar payment basis. Furthermore, repair organizations handling military aircraft during the war had operated satisfactorily on these lines even though the work undertaken was of necessity far less systematic than are periodic overhauls and maintenance. Before the scheme was finally agreed discussions were held between B.E.A., central panels of trade union representatives and local panels, at which details were worked out and the times were set for the various stages of operations.

Agreement to the scheme and its acceptance by these panels was obtained, and it is understood that every effort has been made by the Corporation to explain the system to the men concerned and to secure their co-operation and understanding of the principles involved. B.E.A. introduced the scheme in a genuine effort to reduce manpower costs, which last year amounted to over £1 million, taking the realistic view that a financial incentive would be the best way to achieve more work per man hour without detracting from the quality of workmanship.

As must be widely known the principle on which the premium bonus scheme operates is that times are set for the various stages of maintenance operations. These times are worked out by rate-fixers, who determine the actual number of hours required for various operations. These are indicated on cards and operators clock on and off when the job is started and finished. Whatever time an engineer is able to save on the time set is converted into a cash sum, 50 per cent of which goes into the employee's pay packet and 50 per cent to the employers.

It has been said by some antagonists to the scheme that it leads to a hurrying of the work and a resultant poor quality in the finished job. This argument is not supported by fact since obviously if a hurried or unsatisfactory piece of work is rejected by the inspectors it must be rectified to their satisfaction and no extra allowance of time is given for such rectification. It is clear, therefore, that the engineer whose work passes inspection at the first submission will be saved

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the time and labour of rectification and will consequently earn more bonus. Provision is made by rate-fixers for unforeseen and unusual contingencies so as to save the operator sustaining financial loss through no fault of his own. The hourly basic rate paid by B.E.A. is 2s 7d per hour and the basic times for various operations are calculated to allow men of average ability to earn 15 per cent more than previously.

It is interesting to note that when the strike first commenced the only people who turned up for duty in the C. of A. hangar were the representatives of the panel and the shop stewards with whom it had been agreed that the bonus scheme should operate. B.E.A. claim that during the time when the plans were being formulated many workers' representatives had urged the Corporation to expedite the introduction of the scheme since it was expected to prove popular with those concerned. Moreover, B.E.A. are convinced, if the scheme is given a proper trial, that it will, in fact, prove to be of benefit to both the Corporation and its employees.

CAPTAIN ALCOCK ON SPRINGBOK ROUTE

AFTER having spent the last 12 months instructing at the B.O.A.C. base at Hythe, Captain E. S. J. Alcock returned to operations on November 12th when he left Southampton in command of a Short Solent flying boat on the Springbok route to Johannesburg. Captain Alcock is well-known in South Africa as he was for a time based at Durban during the war where he commanded B.O.A.C. flying boats on the Horseshoe route from South Africa to India through Egypt. Thought to be the most senior pilot in the British Commonwealth, Captain Alcock has logged 21,000 hours' flying, during which he has covered a distance exceeding 3,500,000 miles.

Capt. E. S. J. Alcock.

B.E.A. VIKING ACCIDENT REPORT

IN an accident to a B.E.A. Viking, the official report on which was published recently, which occurred on the northern slope of Irish Law Mountain, near Largs, Ayrshire, on April 21st, the crew of four and nine of the sixteen passengers were slightly injured. Following an uneventful flight from Northolt the pilot was making a ground controlled approach to Renfrew airfield and had passed over the airfield, carried out a procedure turn and lowered his undercarriage, when he became aware that the outer marker beacon had not been heard. Upon enquiring from Renfrew Control he was informed that this beacon was functioning satisfactorily, and it was during a climbing turn calculated to bring the aircraft back into the beam that the aircraft struck the mountain at a shallow angle, just before re-entering the beam. The passengers and crew escaped though the aircraft caught fire and was subsequently burnt out. In consequence of the damage to the aircraft beam approach receiver it was impossible to locate any pre-crash defect but nevertheless, in view of the fact that the captain and the first officer were unable to hear the outer marker beacon signal (which was known to have been functioning) when flying steadily in the beam, it is considered that a failure probably occurred in the marker receiver installation. In the conclusions of the Chief Inspector's report it is observed that the Viking was airworthy at the time of the take-off; the time interval between passing over the inner marker beacon and the commencement of the procedure turn was too long and that the Captain had not appreciated the strength of the wind. In the opinion of the Chief Inspector the accident was due to an error of judgment by the Captain, the failure to receive the outer marker beacon signal having been a contributory factor.

RADAR STORM DETECTION

IN our review (July 1st, 1948) of activities at the National Physical Laboratory, mention was made of the system whereby storm areas can now be located with a high degree of accuracy up to a range of 1,500 miles, by the use of special radar apparatus. Developed by the N.P.L. for the Meteorological Office, the apparatus has been given the name of "Sferics," and is made by the Plessey Co., Ltd., Ilford, Essex.

In addition to the control station at Dunstable, which is, of course, also the central forecasting station and communication centre of the Meteorological Office, there are three other observation stations, respectively at Camborne, Leuchars and Irvinestown, N.I. Each observation station is equipped with cathode-ray direction-finding equipment and an aerial system comprising four multi-turn loops, two of which have a N-S axis, and the other two an E-W axis. The receivers operate on a frequency of about 12.5 kc/sec, equivalent to a wavelength of 24,000 metres, this being the frequency at which maximum energy is radiated by lightning discharges. Furthermore, so low a frequency is free from interference by commercial W/T stations.

Observations are made simultaneously from the four stations twelve times daily, between 7 a.m. and 10 p.m., and the results plotted at Dunstable. The information is then broadcast over the teleprinter network and by W/T, and enables pilots of aircraft, particularly those flying over comparatively short routes to the Continent, to avoid storm areas. The information is also of great importance to the synoptic meteorologist in the analysis of daily weather charts.

ICAO STAFF APPOINTMENTS

MORE than 3,800 replies have been received by ICAO in response to their advertisement of 60 staff vacancies. The replies have come from citizens of 42 nations. The largest number of applications comes from the United Kingdom, whose candidates numbered 957; 939 applications were received from the United States and 427 and 213 from France and Canada respectively. On the average each applicant is interested in about three positions. A list of vacancies, which includes administrative, technical, economic and legal posi-

NORTHOLT STOPPAGE: Some of the B.E.A. fleet grounded at Northolt by the strike of ground engineers referred to in the accompanying pages. All efforts by the Corporation and union officials to persuade the engineers to resume work have so far proved unavailing. The strike originated when 143 ground engineers refused to work under the incentive bonus scheme recently introduced in B.E.A. Cessation of flying is costing B.E.A., and therefore the British public, some £13,000 a day.

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tions, was sent out by the organization to its member states early in June. Letters notifying the states of the vacancies to be filled requested them to notify their own nationals. At the ICAO Second Assembly in June notification was given to delegates. The final date for the receipt of applications originally set for September 1st was extended to September 27th to allow for delays in the transmission of applications from distant countries to the ICAO headquarters. ICAO have pointed out that several of the posts advertised are being filled at present on an acting basis and that those holding the posts temporarily are in many cases also candidates for permanent appointments. Advisory Appointment Boards composed of senior secretariat officials are now undertaking a review of the large number of applications received and the final selection and appointments will be made by the Secretary-General of the organization.

TUDOR 4 PAYLOAD INCREASED

MODIFICATIONS to the Rolls-Royce Merlin engines of B.S.A.A. Tudor 4s have now resulted in the granting a full C. of A. at a new maximum all-up weight of 82,000 lb; this is an increase of 2,000 lb on the previous maximum all-up weight. The payload of the Tudor 4 is now 9,500 lb on the East-West Atlantic crossing under average conditions. The aircraft will therefore be able to carry its full complement of 32 passengers besides a considerably increased volume of freight on all sectors of the Corporation's routes. Hitherto the number of passengers carried between Keflavik and Gander has been limited to 25 thus restricting the through passenger load on that route. The modifications which have been carried out in conjunction with Rolls-Royce, Ltd., have resulted in an increase in power for both take-off and climb. The recording of boost pressure now takes place at the induction manifold instead of at the entry to the intercooler and modifications have been made to the injection pump which give an increase in take-off boost pressure from 20 lb per square inch to 20½ lb per square inch. Resultant increase in power obtained is in the neighbourhood of 35 b.h.p. per engine. At the same time boost pressure for climbing at 2,850 r.p.m. has been increased from 12 to 14 lb per square inch. Although the take-off boost pressure is now 20½ lb per square inch instead of 20 lb per square inch there is, in fact, approximately 1½ lb per square inch increase since the boost pressure is now recorded after the intercooler the matrix of which causes a drop of about 1 lb per square inch under take-off conditions. The increase of 35 b.h.p. per engine and the increase in climbing power enables the Tudor to perform satisfactorily a three-engined climb at 82,000 lb weight. As a result of these modifications the Merlin Mk. 621 engines become Mk. 623. The necessary performance trials took place at Boscombe Down under the observation of B.S.A.A. and A.R.B. officials and the aircraft performance under tropical conditions at a weight of 82,000 lb was proved by further trials at Nassau.

BREVITIES

TRANS-CANADA AIR LINES have established a through rate on services from London and Prestwick to Bermuda via Montreal which will enable visitors travelling to Bermuda to visit Montreal en route without extra expense. Bermuda is in the sterling area.

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By October 1st this year the Scandinavian Airlines System had completed 1,196 crossings of the North Atlantic and 213 of the South Atlantic, carrying 33,454 and 6,419 passengers respectively. The corresponding figures for air freight were nearly 600,000 lb and 162,500 lb.

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During the coming winter B.E.A. are organizing fortnightly courses in London, Liverpool, Glasgow and the Channel Islands for traffic staff. Selected staff from the three Corporations will attend lectures on all subjects connected with passenger and freight handling and booking procedures.

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It has been announced in Australia that a Qantas Empire Airways aircraft left Australia to survey the Indian Ocean route to Johannesburg on November 14th. The route taken was by way of Perth, Cocos Islands, Mauritius and Reunion Islands, the aircraft being due to arrive at Johannesburg on November 20th. The aircraft used is a Lancastrian of the type used on the joint B.O.A.C.-Q.E.A. cargo services between the U.K. and Australia.

* * *

A half share in the Ceylon Government Airways has been acquired by Australian National Airways. Capt. Holyman, the Managing Director of Australian National Airways, signed the agreement recently while on a visit to Ceylon. He has stated that Australian National Airways would operate an internal service within Ceylon and hoped later to develop an extension service to Britain.

* * *

During the third quarter of 1948 the Pan American Airways announced that its subsidiaries had flown 330,825,000 passenger miles (representing an increase of 31,663,000 passenger miles or 11 per cent over the previous quarter. The total distance flown was 17,049,834 miles. During the same period of 1947 P.A.A. subsidiaries flew 15,576,479 miles.

* * *

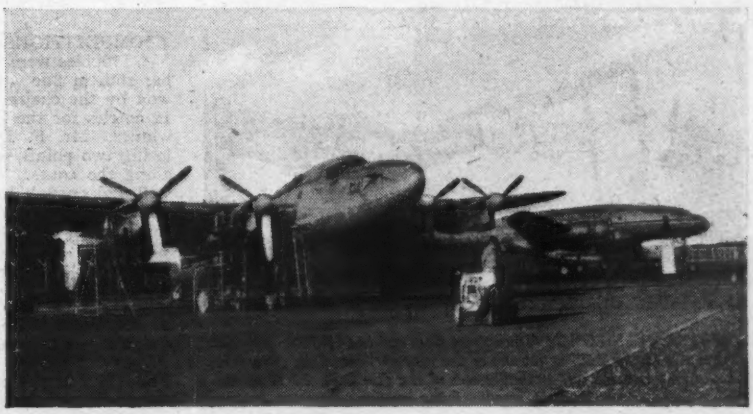
From December 18th B.S.A.A. will increase the frequency of their services between Nassau and Miami to twice daily. This is to provide a service for American tourists who will now be able to make a one-day tour of Nassau. In addition, B.S.A.A. are the only scheduled carriers between Nassau and Havana, thus providing a link between these two tourist resorts so popular with Americans. A special 30-day tourist fare in conjunction with National Airlines and Pan American Airways of $52.50 is charged for the round trip Miami-Nassau-Havana in either direction.

* * *

Three DC-3s have recently been purchased from Scandinavia by Aer Lingus; two of these have been brought from D.D.L., the Danish Airline, and the third from A.B.A. of Sweden. Two aircraft reached Dublin on November 12th. This conforms with Aer Lingus policy to standardize on maintenance and engineering by operating a one-type fleet. The aircraft, previously used as freighters, will be converted by Dublin Airport engineering staffs into 26-seater passenger aircraft. Delivery of these aircraft will bring Aer Lingus' effective fleet up to 13 passenger aircraft, five of which will be easily convertible to all-freight purposes if required. The double doors of the newly purchased machines will facilitate their dual purpose.

* * *

Overhaul periods for Bristol Hercules engines series 630 and 670 as fitted in Viking and Freighter aircraft have been extended from 600 to 700 hours. The Hercules series 763 engines which power the Handley Page Hermes IV have successfully passed their 150-hour type test. The extension of the Hercules 630 and 670 engines to periods of 700 hours between overhauls follows an agreement reached with the A.R.B. last January to run an approved engine by selected operators for a trial period of 700 hours. The extension has shown this period to be well within the range of these types of engine and the extended



QANTAS H.Q.: A Lancastrian freighter and a Qantas Constellation at Kingsford Smith Airport, Sydney. During the last 25 years Qantas has grown to one of the major airlines and employs a staff of nearly 4,000.

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period has therefore been established. Approval for this period between overhauls is restricted to operators who have demonstrated by practical experience that it is consistent with operating conditions. A Bristol 171 helicopter powered by an Alvis Leonides engine is expected to make its first flight soon, and work is also proceeding on a twin-engined helicopter, the Type 173.

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Winter schedules for Air-India International became effective on November 1st from which date the Bombay-Cairo-London service leaves Bombay on Tuesdays and Fridays and arrives in London on Wednesdays and Saturdays. The eastbound flights leave London on Thursdays and Sundays, reaching Bombay on Fridays and Mondays.

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There is understood to have been some resentment in Sweden that the Norwegian shipping firm Rederiet Braathen is expected to obtain permission to operate a weekly air service from Norway through Iceland, Newfoundland and Bermuda to Venezuela. Whereas D.N.L. has raised no objection to the concession being granted, the Swedish press has interpreted it as a Norwegian move to break away from the Scandinavian Airline System.

* * *

The South Pacific Air Transport Council is to meet in Wellington on November 29th, and the Committees of Meteorologists, Air Navigation and Ground Organization will meet on November 23rd also in Wellington. Delegates from the U.K., Australia and possibly Canada are expected to attend. One of the principal items for discussion is to be the location of the international airport in Fiji. Trans-Tasman and Trans-Pacific services and regional services in the South Pacific area will also be discussed.

* * *

The Australian Minister for Air, Mr. A. Drakeford, has announced that the Australian Government has purchased four DC-4 aircraft from Sweden for £A1,000,000, delivery to be taken from the Douglas works at Santa Monica. These aircraft, which became available because of the amalgamation of Swedish Airlines will be used on the British Commonwealth Pacific Airlines trans-Pacific route. The price paid is £A50,000 less for each aircraft than the present ruling price and, as payment is to be made in sterling, no dollars are required. The DC-4s will be collected and flown to Australia by B.C.P.A. crews.

* * *

K.L.M. announce that as from November 1st Commander A. D. Snitslaar has been appointed Flight Division Manager and Commander G. J. Malouin has been appointed Flight Superintendent. Since joining K.L.M. in 1935 Commander Snitslaar has flown 7,300 hours with the company; previously he served with the Netherlands Army as Flight Lieutenant. Commander Malouin, who is an American, entered service with K.L.M. in November, 1945, and was appointed Chief Pilot of the North Atlantic Division in October, 1947. In 1941 and 1942 he was Instructor and Flight Commander at the U.S. School of Aeronautics and afterwards served with the Consolidated Vultee Aircraft Corporation.

FROM THE CLUBS

IT is considered likely that the Orkney Flying Club, which came into being on May 1st this year, will shortly possess an aircraft of its own. Capt. Fresson, who has been taking a very keen interest in the formation of the club, is co-operating in this matter.

* * *

ALTHOUGH the weather in September and October was not very favourable for pilots at the London Aeroplane Club, 292 hours were logged during these two months and five first solos and six more A licence tests were passed. The club's second post-war annual ball has been arranged to take place at the Savoy on January 28th, and there are hopes that the dinner-dance and cabaret tickets will be obtainable for about 35s per head. Endeavours will be made to arrange a motor coach to transport members from Hatfield to the Savoy. More specific details will be available shortly from the club's secretary, telephone number, Essendon 305.

* * *

A BUSY year has been reported from the Wiltshire School of Flying, dual and solo flying having amounted to over 200 hours each month. Lately this has increased, the figures in August amounting to 258 hours, with 273 recorded in September and 281 in October. Altogether 67 new A licences and 10 renewals have been gained since January, 1948. The handicap air race from Thruxton to Totland Bay held in October was most successful, the handicapping resulting in a very close finish with only 5 seconds separating the first two aircraft. Mrs. Taylor-Young was the winner flying the club Autocrat, with Maj. P. Moore, of the Royal Artillery, second. The remainder of the field of eight aircraft crossed the line in rapid succession. All visitors by air are welcome at Thruxton and refreshment facilities are available; no landing fees are charged to club pilots.

* * *

THE winter programme published in the *Redhill Flying Club Gazette*, November issue, which also contains details of the new student pilot's and private pilot's licences, commenced on October 9th with a dinner-dance at the clubhouse which was attended by some 80 members and their friends. The next item was arranged for November 13th in the form of a cinema show followed by a dinner in the clubhouse, after which there was a talk on a subject of interest to members. Entertainment for December will be finalized shortly and members informed as to the details.

* * *

ON Saturday, November 20th the Committee of the South Coast Flying Club has arranged an informal dance, tickets for which may be obtained for the cost of 6s each. It is stressed that future dances will depend on the enthusiasm shown for this one on November 20th. For the convenience of members who are interested in being shown over the Bristol Brabazon, arrangements are being made for parties to fly from Shoreham to Bristol to inspect the Brabazon and have lunch. The cost of the air trip is £4 13s per head (not including lunch) and the flights will be made up of parties of six. Dates for each party can be arranged to suit members. An aerial photographic competition open to all amateur photographers has been organized by the Club and entries (no specific subject) of aerial photographs taken between November 1st and December 31st will be judged by *Flight*. Full details and rules can be obtained from the Club.

* * *

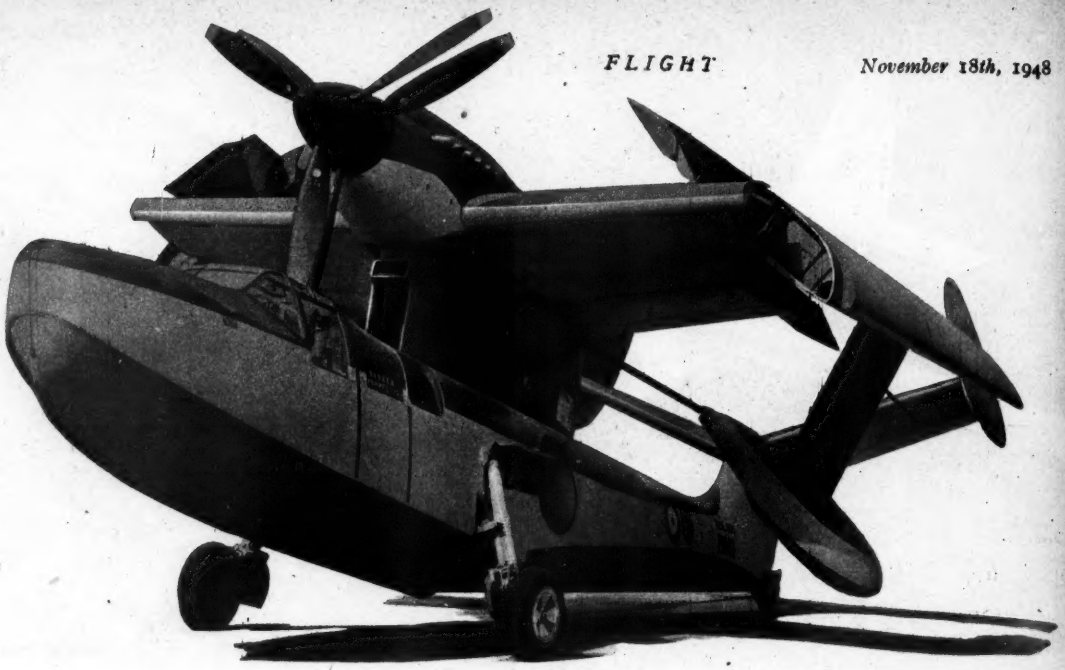
COMPETITIONS for the Rodman, Pemberton and Leeming Trophies were held at the Lancashire Aero Club on October 16th in fine weather; the first of these, the Rodman, was won by the chairman of the club, Mr. W. Armitage. Out of 12 entries for the Pemberton contest Mr. A. A. Orsi was the winner. Mr. F. Dunkerley won the Leeming Trophy, only losing two points in the competition in spite of misty weather along the course. The lecture programme has taken shape well and enough lecturers have been found to enable a complete syllabus to be drawn up. Beginning on November 18th, the lectures will take place on Thursday evenings at 7.30. There will be two lectures each evening, one from 7.30 to 8.15 and the second from 8.30 to 9.15. The subjects and speakers are: Meteorology, M. R. J. Willoughby; Engines and Airframes, H. A. Line; Airmanship, P. R. Jefferies; Principles of Flight, W. L. Woodward; Navigation, a navigator from Sievwrights. Hire rates for Auster 1s are now £6 for the first day, £1 per day for the next three days and £2 per day thereafter. The Tiger Moths can be hired on a similar basis except that the charge for the first day is £5 not £6 as in other cases.

STILL GOING STRONG: Although its slots and head fairing indicate that this Gipsy Moth is not one of the very earliest of the type, it is now 17 years old and probably one of the few D.H. 60 G Moths still in regular flying service.

FEEDERLINERS

THREE light passenger aircraft, the Prince, Dove and Sealand, are the latest examples in a class in which British manufacturers excel. They represent different approaches to the problem of transporting up to eleven passengers on medium-range journeys. For the Percival Prince, which is capable of the longest range of the three, 500 h.p. Alvis Leonides engines produce a cruising speed as high as 185 m.p.h., in spite of the unusually spacious cabin. Float and ski-equipped versions are offered. In the de Havilland Dove, smaller and 2,000lb lighter all up, but having a few pounds more pay load, 345 h.p. Gipsy Queen 70s give power for a high cruising speed of 200 m.p.h. For amphibious duties the Short Sealand (Queen 70s) has features indicative of the maker's long experience of such work. It cruises at up to 174 m.p.h.

D.H. Dove



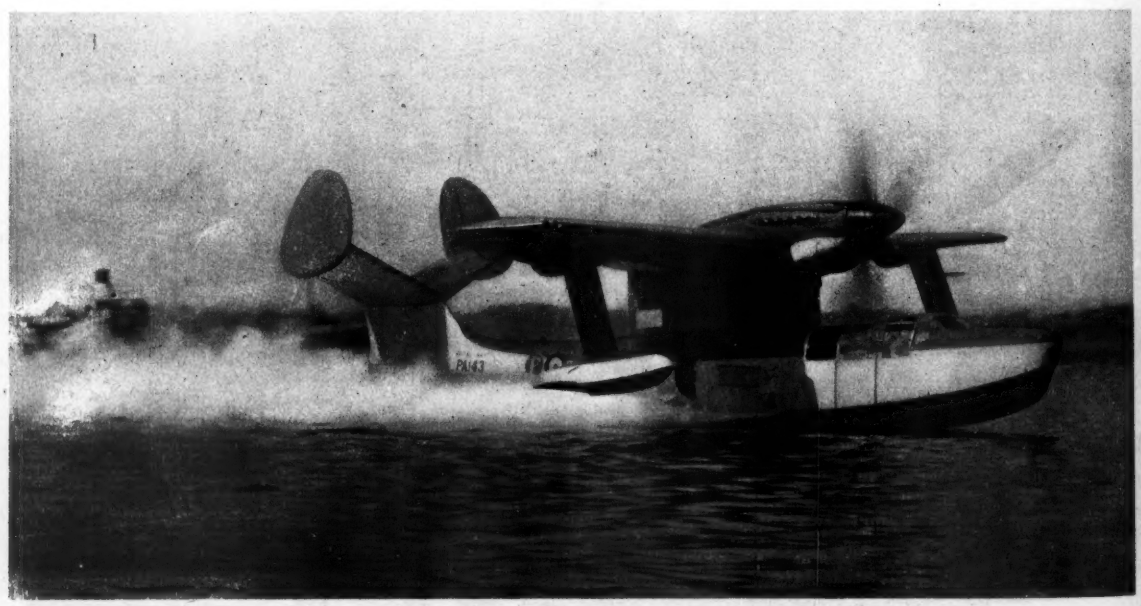
High-Performance Amphibian

A VARIABLE-INCIDENCE wing and a generally high standard of aerodynamic design confer upon the Vickers-Supermarine Seagull amphibian, the first prototype of which is now on test, the exceptionally wide speed range of 54-260 m.p.h. This performance is attainable with a Rolls-Royce Griffon R.G. 30 S.M. engine, to be installed in production aircraft; for the present the power unit is a Griffon 29 of lower output.

Although only a few hours' test flying had been completed, the Seagull, in the hands of Mr. Lithgow, gave a memorable demonstration at the S.B.A.C. Display this year. Particularly impressive was the slow fly-past with the mainplane, leading-edge slats, slotted flaps and slotted ailerons at their optimum setting.

The Seagull was designed to Specification S.14/44, as a successor to the Walrus and Sea Otter biplanes, to which, in spite of its very advanced aerodynamic design, it bears a certain family resemblance. The duties originally foreseen were reconnaissance and spotting, but the first prototype is equipped for air/sea rescue duties. Provision is made for dual control and the Seagull might be usefully employed as an advanced trainer.

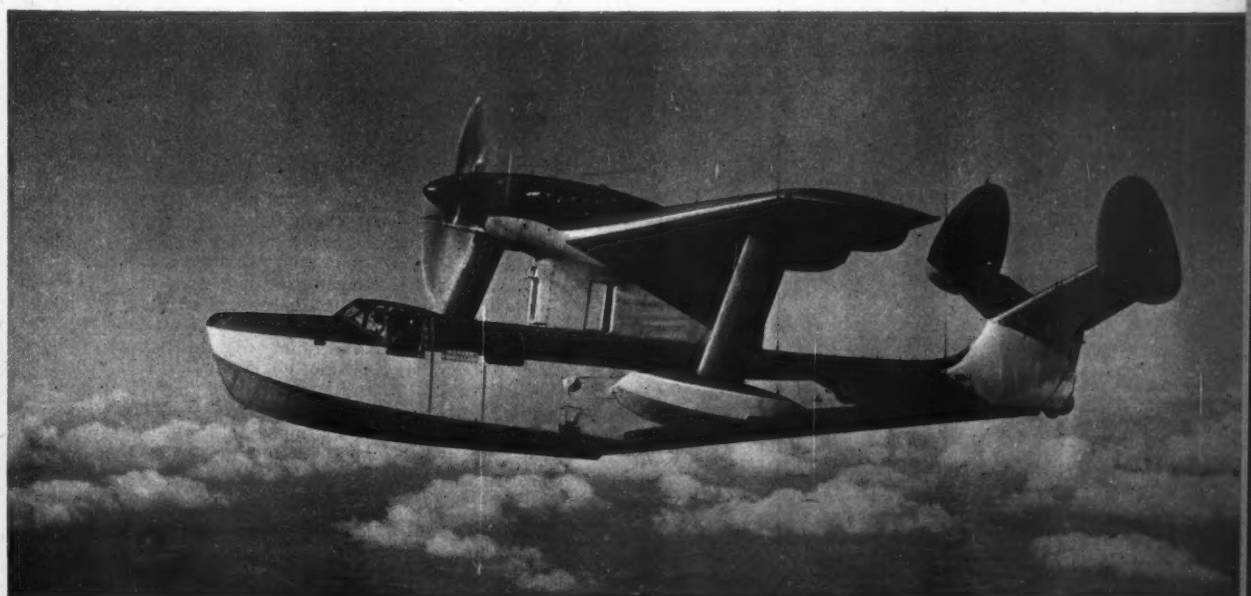
The variable-incidence wing is designed to fold and is essentially similar to that of the "Dumbo" torpedo



bomber, with which Vickers-Supermarine have already amassed a wealth of experience. By means of an electrically operated screw jack the wing may be set at the most favourable angle for take-off, whilst in level flight the incidence can be adjusted to reduce hull drag to a minimum. For landing it is possible to achieve the high angle of attack necessary to develop the unusually high lift coefficient for which the wing has been designed.

In large measure the high speed of the Seagull can be attributed to the clean installation of the Griffon engine which drives a contra-rotating Rotol six-blade constant-speed airscrew. The air intakes and the radiators for coolant and oil are housed in a vertical trunk beneath the engine. A total internal fuel capacity of 285 gallons is available, and the addition of two 60-gallon drop-tanks allows a maximum range, with Griffon R.G. 30 S.M. engine, of 1,230 miles.

The main undercarriage, which is readily detachable, should the Seagull be required to operate only from water, retracts upwards and backwards, the legs being turned through approximately 180 degrees by means of a rack-and-pinion. That the stowage is extremely neat will be gathered from the accompanying photographs, secured during a recent test flight over Southampton Water.



"Walking-out" M. Dollfus's balloon at Cardington. It is of 10,000 cu ft capacity and filled with hydrogen.

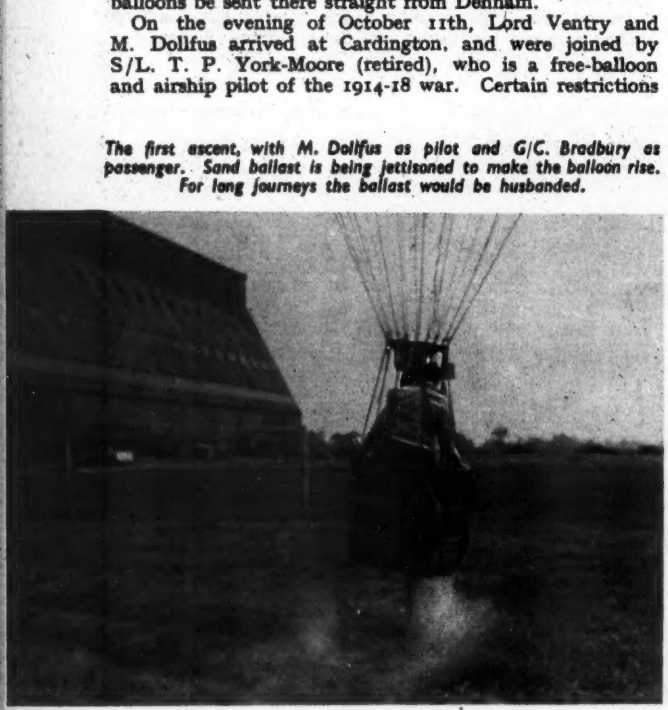
Joys of Ballooning Revived

AFTER a period of many years, during which free ballooning was stopped by the Air Ministry, the sport was resumed when six ascents were made from Cardington on October 13th, 14th and 15th. The owner on this occasion was the famous French aeronaut, M. Charles Dollfus, who happened to be visiting this country with two of his balloons, one of which he was using in the making of a film by The Two Cities Film Company of Denham.

Lord Ventry, an old airship man and free-balloon pilot, and now editor of *The Airship*, got into touch with his friend Dollfus as soon as he heard he was in this country, and negotiations with the Air Ministry and other appropriate authorities were commenced with a view to getting the necessary permission for ascents to be made from Cardington. This permission was readily granted, and thanks are also due to the film company for letting the balloons be sent there straight from Denham.

On the evening of October 11th, Lord Ventry and M. Dollfus arrived at Cardington, and were joined by S/L. T. P. York-Moore (retired), who is a free-balloon and airship pilot of the 1914-18 war. Certain restrictions were imposed, including the stipulation that the balloon flights were to be confined to within a radius of 20 miles from Cardington.

The first ascent, with M. Dollfus as pilot and G/C. Bradbury as passenger. Sand ballast is being jettisoned to make the balloon rise. For long journeys the ballast would be husbanded.



The balloon was already inflated in one of the airship hangars (Cardington, it will be remembered, was formerly an airship station), and instructions were given for the first ascent to be made the next morning, weather permitting. The news aroused great interest in the camp.

At 9.50 a.m. the balloon made its first ascent, with M. Dollfus as pilot and G/C. Bradbury, D.F.C., Station Commandant, as passenger. In subsequent ascents M. Dollfus took up as passengers men from the Kite Balloon Unit. They included S/L. R. Browning, F/S. Bowman, B.E.M., Sgt. Keen, and A/C.1 W. Gamlin.

Nearly a Goal

In the third ascent Lord Ventry was the pilot, and his passenger was Mr. "Jerry" Long, a technical officer of the Ministry of Supply. (It is of interest to note that both Sgt. Keen and Mr. Long are old airship coxswains and free-balloon pilots of the 1914-18 war.) At the start no little amusement was caused by the basket of the balloon bumping a goal post, the balloon being carried away by an eddy formed behind the airship hangar. Useful experience was gained by the handling party in "walking-out" the balloon on this and other bumpy passages from the hydrogen filling station to the airfield.

The whole visit to Cardington was a complete success, thanks to the willing co-operation of all concerned, from the Air Ministry to the ground party. All who took part have undoubtedly gained a lot of useful knowledge about free ballooning, and those without previous experience were made to realise that there is more in the technique of piloting a balloon than might be expected.

Those of the passengers who had done no free ballooning before were amazed to discover what the "old hands" already knew, that in a balloon floating along in no apparent wind the silence and quiet are such that ground noises can be heard very distinctly: the cackling of a hen, the barking of a dog, or the driver of a motor car changing gears.

It is very much to be hoped that M. Charles Dollfus will bring his balloons over to England again next year. By that time perhaps the Royal Air Force may have a balloon of its own. Who knows?

And here is a suggestion for the Air Ministry to ponder: Why not use balloons in a "Join the R.A.F." recruiting campaign as a novel way of advertising. [Balloons were used for advertising long before there were aeroplanes.—ED.] The results might be interesting. T. P. Y.

HERE AND THERE

Dutch Trainer Visit

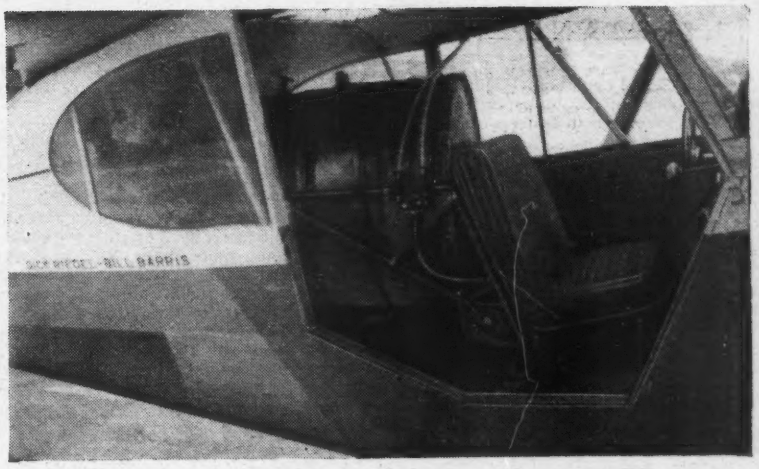
A FOKKER S.11 2-3-seat basic trainer with 190 h.p. Lycoming engine arrived in this country recently and is at present with an R.A.F. training unit. Presumably it is here for examination and trials, but no information is forthcoming at present. Notes on this new design, and photographs, appeared in *Flight* dated October 28th.

U.S. Airlift Cost

THE longest hold-up of the Berlin air lift occurred on November 14th due to thick ground mist and very adverse weather conditions causing a stoppage of almost 19 hours. Mr. Forrestal, American Minister of Defence, said in Berlin recently that his estimate of the cost of the air lift was in excess of £25 million a year. He commented that this was a large sum of money but was a good investment for peace.

D.H. Flying School Looks Back

TO celebrate its record of 25 years' service to R.A.F. training, an informal history has been prepared by the de Havilland School of Flying which celebrated its silver jubilee in April this year. This history, published in brochure form, reviews the activities of No. 1 Reserve Flying School since it started on April 1st, 1923, at Stag Lane. Illustrated with many excellent photographs of personalities and aircraft there are also numerous photographs of the various stages of expansion of Hatfield and Stag Lane airfields. Biographical notes on the instructional staff and other personalities well known at Hatfield and at the school conclude this well-produced record of a quarter of a century's achievement.



AERIAL MARATHON: A photograph of the cockpit of the Aeronca Cub which took off at Burbank, California on October 17th in which D. Riedel and B. Barris are planning to stay aloft for six weeks. Fuel in three-gallon drums, and food are snatched from the ground, and the fuel is transferred to the aircraft tank in the air. Refuelling occupies five hours out of every twelve. The engine has special clearance for 1,003 hours' running without inspection.

U.S. Civil Defence Report

RECOMMENDATIONS for a permanent peace time A.R.P. programme capable of being expanded rapidly in the even of an emergency to combat the effects of every type of modern air attack has been made public by the U.S. Office of Civil Defence. Recommendations visualize the possibility of 100,000 casualties from one explosion and stresses the need for having a nucleus of trained people ready who would be capable of dealing with the results of attacks using atomic and chemical bombs. The report states that "the current unjustified fear of radiological hazards involved from the atom bomb" should be dispelled. The total strength of the forces that would be needed in an emergency is reckoned at 15 millions.

MANPOWER SAVER: A photograph showing one of the R.A.F. "Stacatruc" hydraulically operated fork lift trucks now being used to hasten the turn-round of aircraft on the Berlin air lift.

Flight Index

COPIES of *Flight* index for Volume 52, January-June, 1948, are now available price 1s 1½d post free, or, together with cloth binding case, 5s 4d post free. Copies can be obtained from Flight Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1.

U.L.A.A. Vice-presidents

FOLLOWING on the announcement in *Flight*, October 28th, that Sir Alan Cobham and Mr. P. W. S.(George) Bulman had agreed to serve as Vice-Presidents of the Ultra-Light Aircraft Association, it has now been announced that Captain Sir Geoffrey de Havilland, C.B.E., F.R.Ae.S., and the Rt. Hon. Lord Balfour of Inchyre, P.C., M.C., have also accepted offices of Vice-Presidents of the U.L.A.A.

Nutts Corner Buildings

THE new passenger building at Nutts Corner Airport, Belfast, which, as reported in *Flight*, November 4th, is to be opened by Mr. G. S. Lindgren, Parliamentary Secretary to the Ministry of Civil Aviation, and Mr. Gerard d'Erlanger, Chairman of British European Airways, on November 26th, is a semi-permanent structure which will be replaced by permanent buildings. The new building has been made up of a number of prefabricated hut sections recovered from military camps used during the war.

The Brabazon Advances

STRUCTURE weight of the Brabazon has come out at only 50 lb more than the weight estimated by the designers. Now that the external and structural work is completed activity is being concentrated on the installation of engine controls, flight controls, flight deck equipment, hydraulic and electrical services. The greater portion of the electrical cables, of which there are 150 miles, has now been installed. For two years work has been proceeding on the power-assisted flight controls, and two systems, one hydraulic and the other electric, have been

HERE AND THERE

in process of evolution. Flight tests have been successfully undertaken with the hydraulic method fitted up in a Lancaster aircraft.

Steels for Turbines

IN descriptions of aircraft turbines the phrase "discs are of Jessop steel" occurs with conspicuous frequency. William Jessop & Sons, Ltd., Brightside Works, Sheffield, have recently published an eight-page leaflet briefly outlining the early development, production problems, rigorous testing and inspection of their special high creep-strength steels for turbines. Useful tables of the physical and mechanical properties of a number of these steels are included, and a two-page illustration gives an impression of the manifold process involved in the manufacture and testing of turbine discs and rotors.

Rotol Booklet

PUBLISHED by Rotol, Ltd., for potential customers and users of the firm's products, their new brochure is a most attractively produced booklet introducing the range of equipment manufactured by Rotol's. The airscrew section of this publication contains leading particulars of the range of airscrews applicable to engines of from 300 to 4,500 b.h.p., and opposite each table is a cutaway drawing of the hub in which the complex mechanisms are very clearly depicted in two colour reproductions. Brief description and illustration of the Automatic R.P.M. Synchronizing Equipment follow the airscrew section and the brochure is completed with particulars and illustrations of Rotol accessory drive equipment.

Golfing Society Vacancies

THE Aircraft Golfing Society announces that there are a few vacancies for active members. Eligible for membership are executives of the main aircraft companies or of sub-contracting firms. Those interested should communicate without delay with the Honorary Secretary, S. D. Songhurst, 55b, Woodville Gardens, Ealing, London, W.5.

News in Brief

THE new de Havilland factory at Broughton, Cheshire, which the company took over in June this year, has completed its first aircraft, a Mosquito night fighter, Mark 38.

* * *

Staff at the American establishment at Burtonwood engaged on servicing aircraft for the Berlin air lift has been increased by 800 to a total of 3,000. The first Skymaster freighter on the Berlin air lift to be serviced at the Burtonwood depot returned to Germany recently.

* * *

An interest-free loan of £10,000 has been made by the Western Australian Government to a company named Air Beef Pty., Ltd. Rapid transport of beef from slaughter house to processing plants it is hoped will enable increasing supplies of meat to be made available for shipment to Britain.

* * *

In connection with the International Aviation Building, being erected on the Canadian National Railways Central Station site at Montreal, orders have been placed with United Kingdom suppliers for pressed steel partitions. There is a prospect of further orders for the remainder of this office block.

In recognition of the high standard of marks they obtained during the final year of the Higher National Course 1947-8, four apprentices of Saunders-Roe, Ltd., Isle of Wight, L. C. Collins, V. Haylett, T. Roberts and S. Snow, have been awarded National Certificate Prizes by the Institution of Mechanical Engineers.

* * *

Kigass, Ltd., of Leamington, announce that their engine starting equipment has now completed over a million operations and that a non-stop duration test is to be continued with the vapourization pressure stepped up to 600 lb per sq in.

* * *

The firm of McColl's Asbestos and Plastics announce that as from November 1st their trading title has been changed to "Rubberite," the name by which a number of its products are known.

* * *

A dance for past and present students of the Colleges of Aeronautical and Automobile Engineering (Chelsea) is being held at the Victoria Hall, Bloomsbury Square, W.C.1, on Wednesday, December 1st, for which tickets may be obtained from the Secretary, College House, Princes Way, S.W.19.

* * *

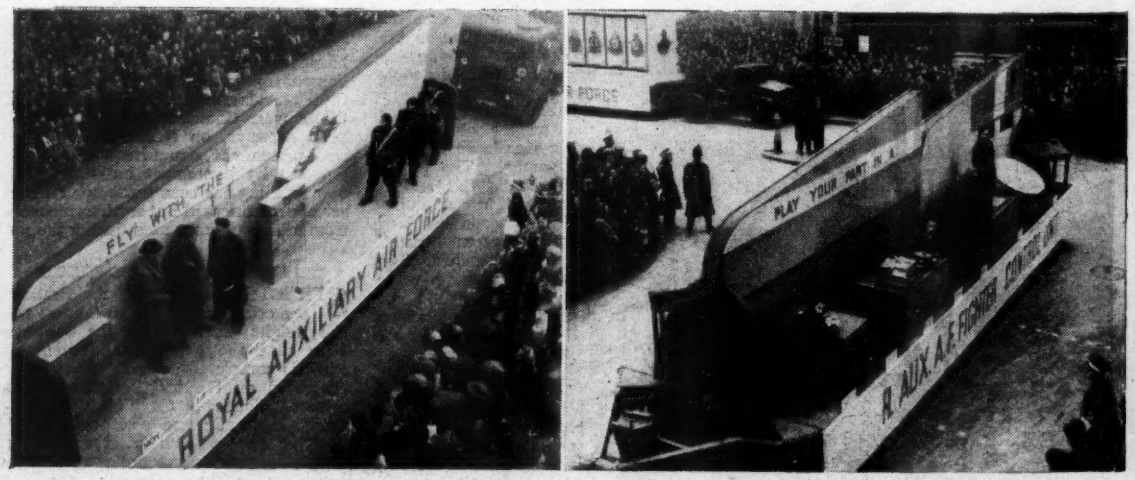
Gold valued at approximately £6,000 was found in the oil tank of an Orient Airways Dakota in Hong Kong recently when the aircraft was undergoing final tests preparatory to a flight to Karachi. Police are investigating the find.

* * *

Following research work carried out with R.N.Z.A.F. Avengers converted to carry fertiliser, the New Zealand Government has approved the purchase of a Miles Aerovan for the purpose of making experiments with aerial top dressing. Steep terrain in some productive areas can only be top-dressed efficiently from the air. Experiments are expected to require 18 months before estimates of large scale fertilization possibilities are arrived at.

* * *

A party of about 70 employees of Dowty Equipment, Ltd., Cheltenham, recently visited the Bristol Aeroplane Company's factory at Filton to look over the Brabazon. They were particularly interested to see the specially designed Dowty undercarriage installed in the aircraft, and in the jig constructed for undercarriage testing.



FIRST APPEARANCE: Two of the R.A.F. tableaux pass through London streets, in last week's Lord Mayor's Show, illustrating the theme—"Auxiliary Forces of the Crown." All six R.A.F. floats, which represent the R.A.F.V.R., R.Aux.A.F., and R.O.C., will later travel round Britain to assist in the Reserve recruiting drive.

"Flight" photograph.

Main hangar and apron at Ypenburg as seen from the control building. Note the Walrus in the background.

Activities at Ypenburg

Servicing and Charter in Holland : The Work of the Frits Diepen Companies

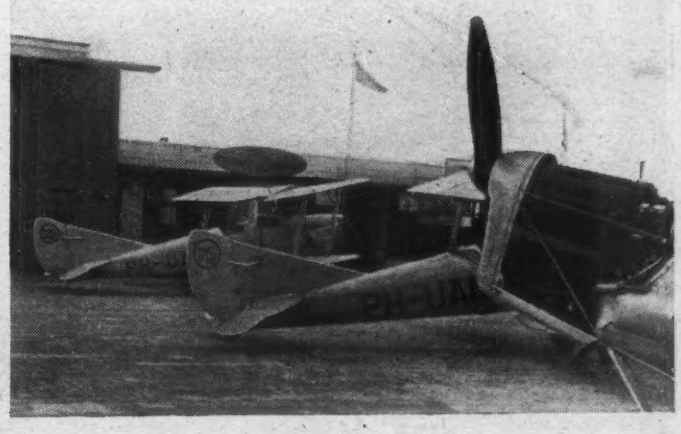
IN this country we are fortunate to have a large choice of concerns available to undertake repair and overhaul work for charter companies and private owners. A very large number of charter companies also continue to operate in spite of the difficulties which they experience. For this reason one is liable to overlook the fact that there are other important European countries with few or even no such facilities.

The world-wide importance of K.L.M., and the many well-known aircraft built by Dutch manufacturers during the years, have placed Holland high in relation to her size on the list of air-active countries. Since the war, however, a fresh start has had to be made, and, as yet, the aircraft concerns in operation are relatively few.

One company with a variety of interests is that of Frits Diepen Vliegtuigen N.V., of Ypenburg. This is, to be exact, the name of the holding company for Aero Holland N.V., charter operators, Avio Diepen N.V., the industrial and trading company, and Aerodrome Ypenburg N.V., the airfield managers.

Each of the subsidiaries has its headquarters at Ypenburg airport, where also operates the National Flying School and the Government Flying School. The former is concerned with all private pilot instruction up to A-licence standard, and may shortly undertake also grading work for the Dutch Air Force. Satisfactory results at the early stages qualify a would-be commercial pilot for entry to the Government school, which is a training unit for K.L.M. and other airline pilots, and members of which wear a uniform. Incidentally, Dutch flying school Tigers are "simplified"—if this is possible—by having considerably increased fin area. A personal opinion was expressed that this may be all very well for the club pilot who may graduate on to a Piper Cub, for instance, and who wants spins to be as gentle as possible, but that it is not so good for a pilot who intends to continue with advanced training and finds the spin of, say, a Harvard something of a shock.

Avio Diepen, Ltd., is one of three important organizations dealing with repairs and overhauls in Holland. The others are, of course, Fokker and K.L.M. Fokker are concerned with airframes only, and this class of work is undertaken as a temporary measure. K.L.M. do their own servicing and a great deal of other work for which they have the facilities. Avio Diepen in addition holds an important concession from the Fokker Aircraft Company in the form of sole selling rights for all Fokker aircraft up to 1,650 lb payload. This, of course, includes



Tiger Moths used by the National Flying School in Holland look rather strange with their greatly increased fin area.

Activities at Ypenburg . . .

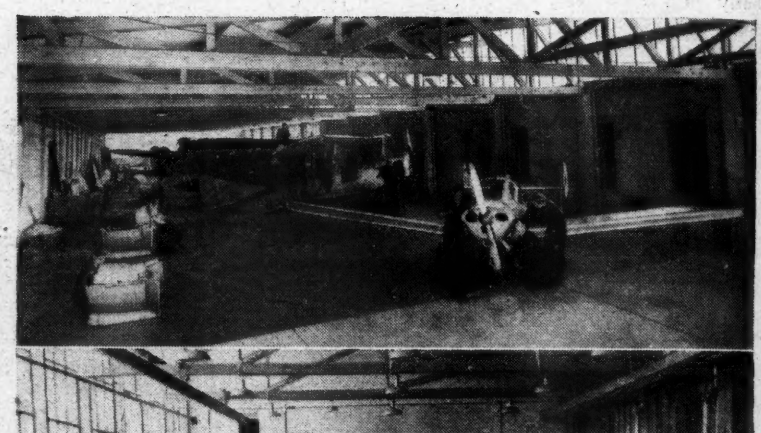
the Promotor and S.11 Instructor, both of which are in production. Reference was made to current military and civil Fokker designs in an article "Fokker To-day" in *Flight* dated October 28th.

Comparatively small as yet, but increasing in size and importance, Avio Diepen undertakes a variety of aircraft work in the smaller classes. The position with regard to engine overhauls may be summed up as follows: Up to 250 h.p.—Avio Diepen; 250-600 h.p.—divided between Diepen and K.L.M.; over 600 h.p.—K.L.M.

Many types of engine pass through the workshops at Ypenburg, and at the time of our inspection Gipsy, Cheetah, Argus, and Continental, to name four, were in various stages of overhaul. Spares are stocked for Gipsy Major, Lycoming and Continental engines. The Beechcrafts, fourteen in number, used by the Government school, also add 28 Pratt and Whitney engines to the numbers requiring regular attention.

The servicing called for by the Flying Schools, Aero Holland associates and many private owners has necessitated a big expansion of Avio Diepen facilities. As fast as equipment and space can be obtained and brought into use, work comes in. On the aircraft side complete overhaul of a seventh Cessna Bobcat is nearing completion for the charter company, three more having been "cannibalized" for spares. Work is also proceeding on the only Dutch-owned helicopter, a Sikorsky 51, which was "dropped" to the detriment of the rotor but with little effect on the main airframe and engine mounting. It is understood that Diepen first obtained permits for purchase of the S.51, but that the Dutch Navy, Ministries, K.L.M., the railways and postal and agricultural departments now all have an interest in it.

Small but efficient radio, electrical, fabric, dope, woodwork and airscrew shops are in operation, and wooden airscrews in the smaller sizes are produced at the airport.

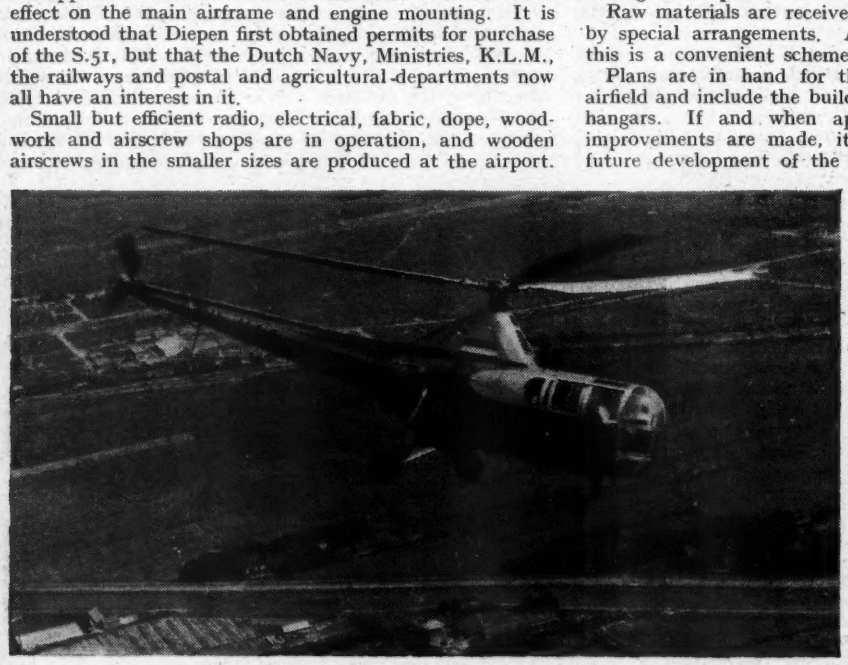


Aircraft and power unit servicing sections of Avio Diepen Ltd. Engine bay partitions serve also as racks for the tools required by the type of unit handled in the bay.

The American Aeromatic Propeller Company is represented by Avio Diepen, who have facilities for inspection, setting and repair.

Raw materials are received tested from Fokker Aircraft by special arrangements. As quantities are quite small, this is a convenient scheme.

Plans are in hand for the development of Ypenburg airfield and include the building of runways and new large hangars. If and when approval is given, and these improvements are made, it will naturally influence the future development of the servicing organization. It is to be expected that The Hague, seat of the Dutch Government, will very soon feel urgently the need of a first-class airport. Possible competition for Ypenburg, which now serves the area, comes from a proposal to construct a new airport at Rotterdam. This is several miles farther south, but for the time being (for reasons of economy) it is probable that the two cities will have to share one main airport. The journal *Vliegwereld* re-



Air-to-air photographs of helicopters are uncommon. This excellent study with Diepen demonstration pilot, Mr. H. Bulten, at the controls, is of an S. 51—the only one registered in Holland.

cently printed a plan of proposed extensions and on this the accompanying illustration is based.

Aero Holland, Ltd., are another company watching airfield developments closely. Their charter work is now extending all over the world and covers most routes with the exception of Atlantic crossings.

Co-operation between Frits Diepen and the Nederland Shipping Company led to the formation of this charter concern, which at present concentrates on passenger conveyance. The associated British Nederland Air Services, Ltd., of London, which operates from Bovingdon, specializes in the carriage of freight. Aero Holland expect, however, to take delivery of a third Dakota conversion in January, and this will be equipped as a freighter.

Enterprising Charters

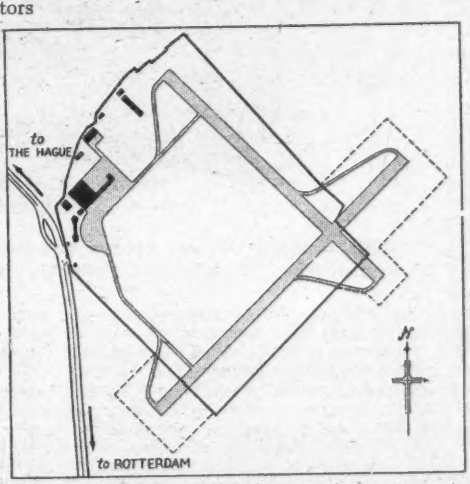
Some interesting charters have been undertaken during the year in connection with pilgrimages to Mecca. For example, European business men are first taken to, say, Johannesburg; the aircraft is then used to take air pilgrims from Zanzibar to Djedda or Mecca before returning with the passengers from Africa to Holland.

Another charter operation which was an all-round success last season was the transportation of spectators to international football matches. The fare from Amsterdam to London and return was 100 guilders (10½ guilders to the £1).

Later, the air transportation of fruit and vegetables grown in Holland may become an important "line," and already aerial tours of the country are beginning to become popular. From personal experience it can be stated that Holland is particularly interesting and well suited to air sight-seeing.

A fleet of small aircraft look after Aero Holland joy riding activities—8 Koolhoven FK 43s, 6 Cessna Bobcats and a Beechcraft D-18 are available. Three old Fokker S.9s have now, like our old 504 Ns, been relegated to banner-towing, a job they do quite satisfactorily. One day some Fokker Promotors may be added to this fleet.

(Top) A Promotor demonstrator at Ypenburg. The restaurant, offices and control tower are in the background. Below is the Diepen-Difoger 421, built "under cover" during the occupation. A Ford engine drives the four-blade airscrew.



Plan of Ypenburg airfield with proposed extensions and runways indicated.

The Frits Diepen companies are fortunate in having virtually a clear field for their work and in being assured of employment to capacity for many months to come. This has in no way impaired the enthusiasm of those concerned, and a visitor gains an impression of activity from executives down. There is a good example of the enthusiasm for aviation shown by Mr. Frits Diepen himself. During the later stages of the war, with a handful of assistants, he succeeded in designing and building an aircraft in secret, using a small automobile workshop for the job. The aircraft is powered by a geared Ford V.8 engine developing 98 b.h.p. at 3,400 r.p.m.—this being the only thing available. The aircraft, known as the Diepen-Difoger 421 (Difoger after the automobile concern whose workshop was used), when it took off almost three years ago, became the first post-war Dutch aircraft to fly. It is a two-seat, twin-boom pusher bearing a superficial resemblance to the F.25 Promotor. The prototype is illustrated above. There is no intention of producing 421s.

M. A. S.

FORTHCOMING EVENTS

Nov. 19th.—Institute of Navigation: "Magnetic Compass Problems—A Fresh Approach," Dr. G. N. Harvey, O.B.E.

Nov. 20th.—Joint Meeting Royal Aeronautical Society and Helicopter Association. Full day Discussion on Helicopters.

Nov. 24th.—R.Ae.S. (Graduates and Students): "The Investigation of Aircraft Accidents," A. Cdre. Vernon S. Brown, C.B., O.B.E., M.A., F.R.Ae.S.

Nov. 25th.—Royal Aeronautical Society: "Development of the Armstrong Siddeley Mamba Engine," W. H. Lindsey, M.A., A.F.R.Ae.S.

Nov. 26th.—R.Ae.S. (Portsmouth): "Lighter-than-air Craft," Lord Ventry, Companion R.Ae.S.

Nov. 27th.—S.L.A.E. (South Eastern Area): "Gas Turbine Power Plants," by D. H. Mallinson, B.Sc., Manson House, 26, Portland Place, London, W.1, at 3 p.m.

Dec. 1st.—R.Ae.S. (Weybridge): "The Island Campaign," W. Courtenay, M.M., A.R.Ae.S.

Dec. 1st.—Royal United Service Institution: "Airborne Forces," Major General A. J. H. Carsels, C.B.E., D.S.O.

Dec. 1st.—R.Ae.S. (Luton): "The Light Aeroplane and the Future of Private Flying," P. G. Masefield, M.A., F.R.Ae.S.

Dec. 2nd.—R.Ae.S. (Isle of Wight): "The Development of the Armstrong Siddeley Mamba Engine," W. H. Lindsey, M.A., A.F.R.Ae.S.

Dec. 2nd.—Royal Aeronautical Society: "Problems in the Development of a New Aeroplane," G. R. Edwards, M.B.E., B.Sc., F.R.Ae.S.

Dec. 3rd.—R.Ae.S. (Portsmouth): Film, "How an Aeroplane Flies."

Dec. 7th.—R.Ae.S. (Graduates and Students): Papers read by Members.

Dec. 7th.—Handley Page Engineering Society: "Aircraft Photography" John Yoxall.

Dec. 3th.—R.Ae.S. (Preston): "Gusts," Prof. A. A. Hall, M.Sc., M.A. F.R.Ae.S.

Dec. 9th.—R.Ae.S. (Coventry): Lecture by E. Smith.

Dec. 15th.—R.Ae.S. (Weybridge): Annual General Meeting.

SOCEMA Aircraft Turbines*

The Record of a French Development Programme

THIS lecture, "French Turbo-propeller and Turbo-reaction Engines" by P. Destival, gives an account of development work on aircraft turbines by a team of French technicians, Société de Construction et d'Etudes de Matériels d'Aviation, working during their Occupation years in virtual isolation from the engineering world. The existence of British and German jet engines was unknown at the time and their approach to the problem was understandably different to that in Britain. Their first effort was a turbo-prop unit with a vaporizing combustion system. The Author is Head of the Research Department of the Cie Eléctro-Mécanique, the parent company.

IN 1941 we undertook a turbo-propeller project with the help of the Service Technique du Ministère de l'Air, at that time in the Free Zone. Our project was designated the TGA, which could either stand for "Turbo-Groupe d'Air" or "Turbo-Groupe d'Autorail," the second version being intended to deceive the Occupiers. To make the latter denomination more plausible, the contract was placed by the French Railway Authority. M. Girodin, who was responsible for the Amiot 351, worked out an aircraft project concurrently with our first turbo-prop design.

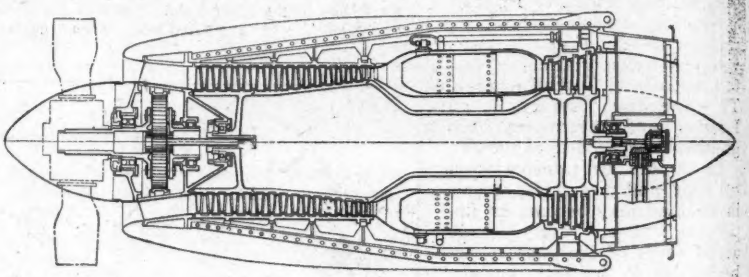
Light construction and the problem of combustion presented enough difficulties to make us conservative towards the cycle, which was characterized by a compression ratio of 3.6 and a temperature ahead of the turbine of 550 deg C at cruising and 600 deg C at maximum power. The unit was due to give a total cruising power of 3,000 h.p. at sea level. Fuel consumption, in view of the thermal cycle adopted, was to be 0.78 lb/h.p./hr at sea level and 0.546 lb/h.p./hr at 32,800ft at 310 m.p.h. Designed weight was 4,960 lb and the maximum diameter 44.9in. It was obvious in 1941 that the unit would have to be made under difficult industrial conditions. These led us to provide a single rotor for the compressor and turbine, made up of welded drum elements, and carried by only two bearings.

The compressor has 15 stages for a compression ratio of 3.6; this means a rise of temperature of only 10.5 deg C per stage. The type of compressor of which we had experience was one with 50 per cent reaction, Mach number 0.6 and blade angle of about 45 deg. These characteristics gave an axial speed of only 246 ft/sec, and an unacceptably large diameter at the entry. To increase the axial velocity and the specific work per stage, we chose a reaction percentage of nearly 100 for the first stage, which meant a Mach number of 0.9 at the tips of the moving blades. From this alarming figure we decreased reaction percentages for the following stages, down to 50 per cent at the seventh, with the axial velocity decreasing from 426 to 246 ft/sec.

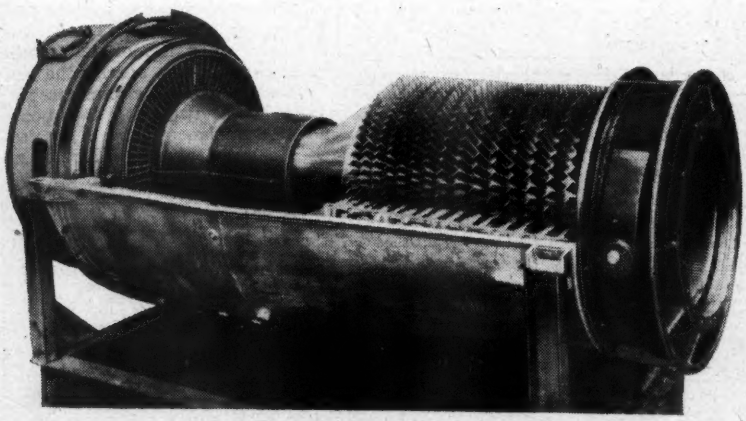
There was great temptation to use a high aspect ratio for the blades. For the first stages of a compressor the bending and centrifugal stresses generally allow quite high aspect ratios, and the latter are limited mainly by considerations of vibration frequency. For a given profile, in compressors of any size if tangential velocities are similar, the ratio of natural frequency of the blade to angular velocity of the rotor shaft depends only on the blade aspect ratio. The probability of exciting vibrations up to a dangerous strain is less for a high frequency than for a low-frequency blade; the most violent excitation phenomena being usually at rotation frequency or a low multiple thereof.

Contrary to modern practice, the first stages of the compressor were in steel and the later ones in light metal. We adhered to steel for the first stages in order to resist erosion and also because we mistrusted the fatigue strength of light alloys. The blades are fixed by a milled dovetail on an integrally forged flat foot.

Being mounted on a common rotor, the turbine had to accurately balance the axial thrust of the compressor. This requirement determined the diameter and hence the number of stages. It would have been possible to use three stages, but we chose four in order to get near to a reaction percentage of 50 at the mean diameter and not below 15 at the inside diameter. This was to obtain the optimum efficiency as, with the cycle chosen, a gain of one per cent in turbine efficiency meant nearly four per cent gain in useful power and consumption.



TGA-1 Turbo-prop unit with 15-stage compressor, atomizing combustion system and 4-stage turbine.



With a casing half and the combustion chamber removed, the compressor, rotor shield, and the laced vanes of the turbine nozzle of the TGA-1 are exposed.

The turbine blading was treated like the low-pressure blading of a steam turbine. It had high aspect ratio blades fitted with vibration damping threads. We designed for an almost irrotational flow, with a correction which allowed us to keep a radially constant profile for the fixed blades and a constant exit angle for the moving blades at each stage, thus simplifying machining. The turbine gives the expected performance and its optimum efficiency is over 88 per cent.

The maximum temperature ahead of the turbine was to be 600 deg C, corresponding to a working temperature for the first row of moving blades of 550 deg C. At this temperature and for an allowable blade root stress of 8.25 to 10.15 tons/in² from the first to the fourth moving row, there are now many suitable materials. At the time (1941) we chose Jacob Holtzer 1480 steel, which at 550 deg C has a creep limit of 12.7 tons/in² according to the Veritas definition (a

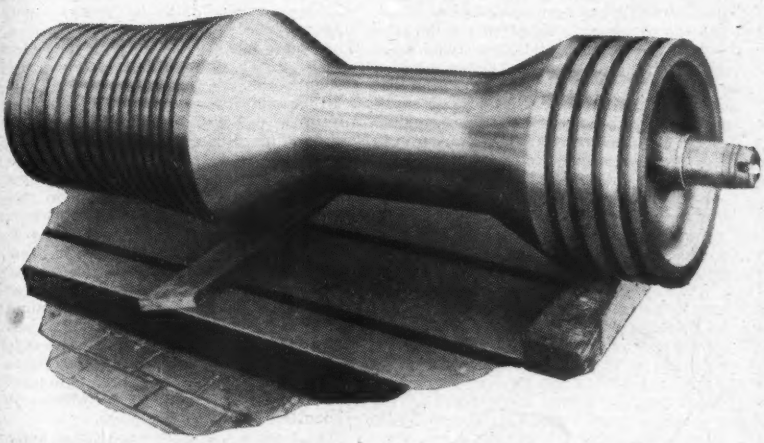
* *Abstracted from a Paper read before the Royal Aeronautical Society, November 11th, 1948.*

SOCEMA Aircraft Turbines . . . . .

plastic strain increase of 1/100,000 per hour, measured between the 25th and 35th hours). This steel, forgeable in large sizes and easily weldable, was also used for the turbine discs and for the drum between the turbine and compressor. The compressor drum was in CMO7 chrome-molybdenum steel, which could be welded to the 1480 steel and had a higher elastic limit, 34.8 tons/in², when cold. The fixed blades, which were more highly stressed than the moving ones, were in ATVS grade of the Acieries d'Imphy, which had a Veritas creep limit of 19 tons/in² at 600 deg C.

To achieve a combustion chamber within an acceptable volume, we had to get a combustion rate ten times higher than the maximum known at the time, in forced-draught boilers. We had to avoid pressure loss as, in a turbo-prop unit, a relative pressure drop of three per cent means nearly 10 per cent increase in specific consumption. Experience with the combustion of gaseous fuels, and a few tests with vapourized petrol, indicated the possibility of obtaining the required rate. Combustion of petrol vapour on grids or honeycombs can take place under good conditions up to speeds of 18.7 to 25.3 ft/sec. Allowing a speed of 18.7 ft/sec for the mixture of primary air and vapourized fuel, which means about 20 per cent of the total air flow, and 82 ft/sec for the velocity of secondary air, it can be shown that it is possible to get 1,200 h.p. per atmosphere per square foot of combustion chamber section. The blue flame anchors itself on the edge of each honeycomb cell, its cone length is very small, and the passage of the primary air through the grid is at such a low speed that the pressure drop is negligible. There remains the intrinsic pressure loss of combustion, resulting from the increase in gas velocity due to change in volume. In our case, this increase was from an average value of 68.9 ft/sec to 134.5 ft/sec, which means a loss of less than 0.2 per cent. Finally, as combustion takes place with a non-radiating blue flame, the burners and chamber walls would be free from hot points.

All these theoretical advantages were to be paid for dearly. It was necessary to mix the hot gases and secondary air without turbulence, so 48 burners shaped at thin sectors were used. Although the flame length was only 3.21n from the burner grid, a total chamber length of 19.7in was deemed desirable as a precautionary measure and also to ensure perfect mixing. Difficulty was experienced in arranging for the correct proportion of fuel and primary air for each burner sector. Some were too rich and some so poor that the flame was lost immediately the speed was varied. Fuel was vapourized in a coil surrounding the combustion chamber and fed to the burners by heavy and cumbersome collectors. Tests showed that indifferent distribution of fuel between burners, and between channels of individual burners, caused a lack of flexibility and a high proportion of unburned fuel. Eventually the vapourizing system was provisionally abandoned and an atomizing system, which could be accommodated in the chamber length of 19.7in, was adopted.



The combined compressor and turbine rotor of the TGA-1 is of welded drum construction.

The unit turns at 6,350 r.p.m. and the propeller at 1,100 r.p.m. A single-stage epicyclic reduction gear, weight 523 lb, diameter 19.7in, length 15.7in, transmits a maximum of 2,560 h.p. with the efficiency of the order of 98 per cent. The compressor and turbine cylinders were mounted within a sheet metal shell, divided on a vertical plane, which ensured the rigidity and pressure-tightness of the unit. This shell had on its rear face four very robust lugs for attachment to the aircraft wing spar. The cowling was closely fitted and did not exceed the specified maximum diameter. Auxiliaries, gathered into a compact group and mounted in the wing leading edge, were driven by shaft through bevel gears from the rear turbine disc.

During the Occupation we were unaware of the existence of British and German turbo-reaction engines, but from January, 1944, the B.B.C. talked about aircraft without propellers. We suspected that the power units must be turbo-reaction plants derived from the work of Air Cdre. Whittle, of whose first patents we were aware. From the German side we heard rumours of the existence of reaction aircraft, but had no clue as to the kind of engine used. It was immediately after the Liberation, August, 1944, that partially destroyed Jumo 004 jet engines were found in a burnt-out German lorry near Orleans.

Axial-flow Jet Unit

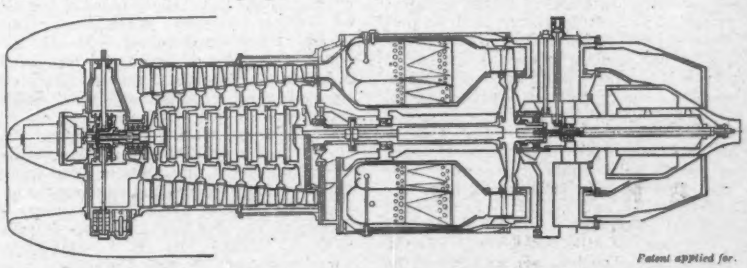
The S.N.C.A.S.E.* asked us to design a jet engine for a projected fighter-bomber. We agreed upon a unit, designated TGAR-1008, with a static thrust of 4,180 lb, diameter about 39in, weight 2,645 lb, and a minimum consumption of 1.18 lb/lb/hr. Such characteristics seemed to compare quite well with those of the Jumo 004, but, luckily, we did not know of the Rolls-Royce Nene, for otherwise we should perhaps never have proceeded with our turbo-jet engine. We made a close study of the Jumo compressor which, with moving blades similar to ours, had a temperature rise per stage of 16.5 deg C with an excellent efficiency. The efficiency of the Jumo is 83 to 84 per cent at its maximum speed of 8,700 r.p.m. and not 78 to 79 per cent as has been published. The latter figure was measured on a unit fitted with an entry diffuser, which was determined by conditions of optimum performance at speed and causes high losses under static conditions.

We designed an 8-stage compressor with 100 per cent reaction giving an actual temperature rise of 20 deg C per stage with a compression ratio of 3.7. This apparent change in policy was due to the fact that high compressor efficiency is of less importance for a turbo-jet than for a turbo-prop, while minimum weight is, perhaps, more important.

The high weight of the turbine influenced us to bring its second bearing to the exhaust side, as a precaution. This weight was the result of our desire to ease manufacture. The blade fixing was of the multiple lug type instead of the more efficient fir tree type which requires more complex tooling.

The fixed blades of the turbine distributor (nozzle ring) embody a special

* *Société Nationale de Constructions Aeronautiques de Sud-Est*

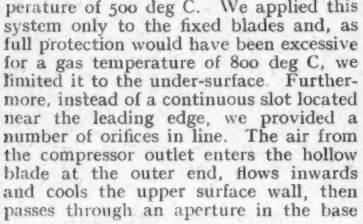


Patent applied for.

TGAR-1003 Turbo-jet unit with duplex combustion system and "bullet" control of jet cone.

SOCEMA Aircraft Turbines

cooling arrangement based on the ideas of M. Darrieus, Chief Engineer of the Cie Eléctro-Mécanique. These relate to the protection of the blades by means of a boundary layer of cold air and we had made systematic tests on this scheme well before the war. It had enabled us to operate a turbine at 900 deg C gas temperature without exceeding a blade temperature of 500 deg C. We applied this system only to the fixed blades and, as full protection would have been excessive for a gas temperature of 800 deg C, we limited it to the under-surface. Furthermore, instead of a continuous slot located near the leading edge, we provided a number of orifices in line. The air from the compressor outlet enters the hollow blade at the outer end, flows inwards and cools the upper surface wall, then passes through an aperture in the base



Patent applied for.

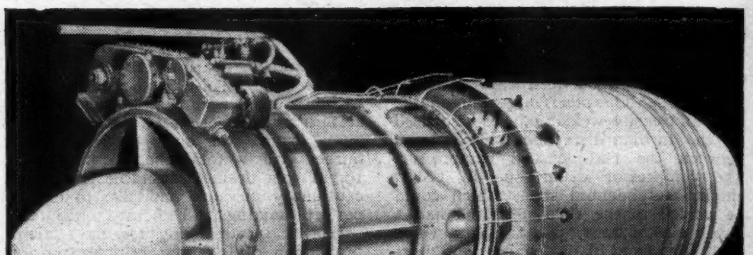
Turbine nozzle assembly for TGAR-1008. The hollow sheet metal blades are drilled near the leading edge for the emission of a protecting layer of air.

of the internal baffle plate to the under-surface wall and feeds the orifices. With a protecting air flow of about one per cent of the total, the nozzle blades work at a temperature 250 deg C lower than that of the gases after combustion.

Fixed and moving blades are in Jacob Holtzer Sirius HT, an austenitic steel with a creep of 0.5 per cent in 300 hours at a stress of 9.52 tons/in² at 700 deg C and 15.2 tons/in² at 600 deg C. Fixed blades are made from 1.5 mm sheet and the moving blades are machined from stampings. The turbine disc is in Jacob Holtzer 1480 steel. The compressor is completely in light alloy; moving blades being stamped to finished size by the Compagnie Générale du Duralumin.

In 1945 the only example of an atomization combustion chamber we had was the Jumo 004, which was hardly encouraging (duration 25 hours, unburnt proportion 12 per cent). At first we provided a vapourization combustion chamber on the same principle as that tried on the turbo-prop unit, but the problem was much more difficult. Vapourization could not be effected so simply in a coil surrounding the combustion chamber and we had to provide two coils located in the turbine efflux. Injectors were fitted behind the turbine to heat the coils initially and a start was achieved in about 30 seconds.

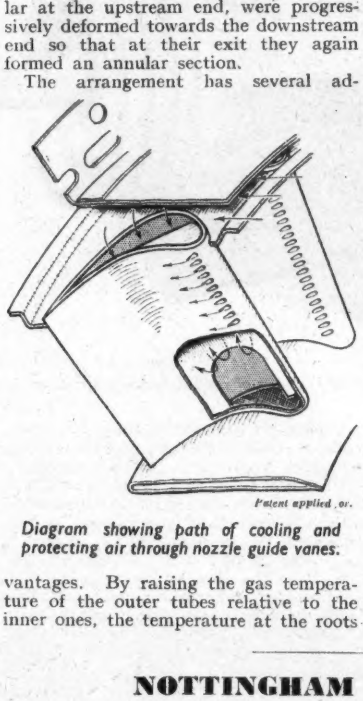
In view of the drawbacks of the vapourization system we undertook the development of an atomization chamber.



On the jet unit auxiliaries are mounted at the forward end. The annular combustion chamber has twenty interconnected flame tubes arranged in two concentric rings.

The annular chamber accommodated a number of flame tubes of different diameters disposed axially on two concentric pitch circles. These tubes, circular at the upstream end, were progressively deformed towards the downstream end so that at their exit they again formed an annular section.

The arrangement has several advantages. By raising the gas temperature of the outer tubes relative to the inner ones, the temperature at the roots of the moving blades is reduced and thermal stresses in the disc are lowered. The small inner tubes take 27 per cent of the total flow and a temperature difference of 200 deg C between the two zones would mean an average temperature only 50 deg C lower than the maximum. This difference can be controlled and, if desired, could be varied with engine r.p.m. providing atomizers are fed with independent values of fuel pressure. At high altitude, if thrust is to be reduced to as low a value as possible, the fuel supply to the larger tubes is cut off and the supply to the smaller tubes adjusted to a pressure sufficient to maintain a stable flame with minimum richness. The unit then works almost in autorotation and it should be possible to avoid blow-out and ensure re-ignition of all tubes when required. Control gear, though complicated, offers no difficulties in principle.



Patent applied for.

Diagram showing path of cooling and protecting air through nozzle guide vanes.

This chamber with separate flame tubes is now enabling us to dispense with the turbine rear bearing and to replace it with a front bearing, supported from the outer cylinder by arms crossing the chamber through the secondary air flow between the flame tubes.

Our turbo-jet unit is regulated by r.p.m. The Société Bonzavia undertook the design of the regulator, which is based on that of the Jumo. Fuel supply is carried out by high-pressure gear pumps which, together with all controls and auxiliary drive gear, were manufactured by the Société Air-equipment.

NOTTINGHAM U.A.S. DINNER

SPEAKING at the Third Annual Dinner of the Nottingham University Air Squadron, A.V-M. R. O. Jones, C.B., A.F.C., recently appointed S.A.S.O. of Reserve Command, assured members and guests that the C.-in-C. was very pleased with the progress of the Squadron. During the past year the 26 officer and 36 Cadet members of the Squadron flew 1,340 hours in term time, and 800 hours during the summer camp. Replying to the toast "The Guests," proposed by the Commanding Officer, S/L. E. Cornish, Mr. B. L. Hallward, Vice-Chancellor of the University, expressed confidence that members of the N.U.A.S. would appreciate their opportunities to maintain the cheerful discipline necessary in the Service after the post-war lapse. Cadet Pilot I. M. Gifford, speaking for the members, mentioned their gratification that the combined U.A.S. Camps were in being, and suggested that a rally of all University Squadrons, even if only for a week-end or so, would be a good thing. S/L. R. Hewitt, A.F.C., who succeeds S/L. Cornish as C.O., promised that he would do all in his power to maintain the reputation of the Squadron. S/L. Cornish is leaving to take up an appointment at Air Ministry.

Ramjets

A Contribution to their Theory and Performance

IN aeronautical report A.R. 3 N.R.C. 1674, Demetrios Samaras, of the Division of Mechanical Engineering, National Research Council of Canada, surveys the field of ramjet operation and offers various adductions to the operational theory of this form of prime mover.

In general, fundamental design requirements for a ramjet should be (i) low external drag, (ii) low internal drag, (iii) high combustion efficiency, including flame stability over the entire range of operation, (iv) easy regulation, and (v) low power plant weight. The internal flow phenomena are similar both for the subsonic and supersonic conditions, but the external flow differs and a different configuration is required.

Considering external losses at subsonic speeds, the report states that the critical compressibility speed of a ducted jet has been found to be as high as that of the basic streamline body, and the external drag with airflow through the body did not exceed that of the basic streamline body. Tests have proved that the length ratio (ratio of length to maximum diameter) of the nose inlet is the primary factor governing the maximum critical speed, and that the effect of the inlet diameter ratio (ratio of inlet diameter to maximum diameter) is of secondary importance. The latter quantity, however, in conjunction with the temperature ratio due to heat addition, determines the inlet velocity ratio (entry air velocity to flight speed) upon which the external drag largely depends.

An inlet velocity ratio smaller than unity results in a divergence of the streamlines in front of the entry, and the smaller this ratio, the more careful should be the design of the external fairing. It has to be remembered that the flow conditions in the combustion chamber and the propelling nozzle will considerably affect external flow.

It has been found that inlet velocity ratios equal to, or greater than, 0.3 result in total head pressures at inlet practically equal to that of the free airstream.

Supersonic Requirements

For supersonic velocities, a somewhat different configuration should be adopted. The use of a reversed de Laval nozzle to convert the kinetic energy of the free stream into pressure was found to be unstable and finally led to a normal shock wave at the entry; this resulted in high external drag and low pressure recovery. Furthermore, the use of a straight pitot tube at high flight Mach numbers was found to be inefficient because of the appearance of a normal shock wave at the entry. Means must thus be found to overcome these difficulties.

One such method embodies a central core placed coaxially within the entry duct. The function of this conical nose is to induce a series of weak oblique shock waves and finally to end in a normal shock wave that will bring the flow into the subsonic region. This will result in a high pressure recovery that otherwise could not be achieved by a single normal shock wave. After a theoretical analysis, it was found that, for optimum conditions, the strength of the oblique shock waves should be the same, which means that the total head pressure ratio across the oblique shock waves should be identical. It was also found that, in order to keep the pressure recovery at a certain level, the number of oblique shock waves should be increased with increasing forward Mach number.

From the experimental work done, it was found that the two requirements of high pressure recovery and low external drag were in conflict, but from the meagre experimental results available today, it may be inferred that the skin friction coefficient decreases with the Mach number.

Boundary Layer Effects

The boundary layer on the conical nose has a great influence on shock wave formation. Tests in a large wind tunnel showed that the effect of the boundary layer on a short nose with one re-entrant angle was small, but the influence on a long nose was, however, important; an additional weak shock wave was observed in front of the transition point due to the thickening of the boundary layer. Photographs have shown that the boundary layer grows rapidly in front of each re-entrant angle. The sensitivity of the conical nose boundary layer effects depends, therefore, both upon its length and the number of re-entrant angles. There is evidence to show that boundary layer processes in the presence of rising pressure completely change the structure of the flow. The shock wave pattern is very sensitive to the nature of the boundary layer and depends entirely on whether the flow in the layer ahead of the shock wave is laminar or turbulent.

When the Mach number is just above unity, and the boundary layer is laminar, multiple shock waves occur, decreasing in number with an increase in Mach number, until finally a simple branched shock wave appears. This results in a large thickening of the boundary layer behind the shock wave and in high losses. The increase in thickness of a laminar boundary layer passing through a shock wave is higher than that corresponding to a turbulent layer. The latter gives only non-branched shock waves and it is immaterial whether the turbulence is made naturally or artificially.

Internal Losses

The author of the report analyses internal losses as being made up of (i) entry losses, (ii) diffuser losses, (iii) combustion chamber losses, and (iv) expansion losses. The first quantity has been surveyed in conjunction with the external losses already dealt with.

From tests on subsonic diffusers, it has been found that the main design parameter is the inlet velocity ratio times the tangent of the diffuser angle, i.e., $\frac{V_{ent}}{V_{amb}} \cdot \tan \theta$. This implies that larger diffuser angles may be used if the inlet velocity ratio is kept low, e.g., if the airflow has already begun to diverge outside the diffuser. In a given diffuser it was found that the loss was neligible up to $\frac{V_{ent}}{V_{amb}} \cdot \tan \theta = 0.16$.

The flow conditions before and after the diffuser have a great influence on the losses. In a ramjet entry diffuser there is always a velocity ratio smaller than unity, and thus the divergence of the external streamlines assists the flow to follow the diverging walls of the entry.

In diffusers with high Mach number subsonic flow, two counteracting effects are present; a higher pressure recovery per unit length, and a greater breakaway tendency. Experimental evidence has shown that a sudden drop in efficiency occurs in the neighbourhood of $M = 0.92$. The optimum diffuser angle found was $\theta = 3.5$ deg.

Boundary layer effects play an important rôle in a diffuser. In a large angle diffuser, a higher pressure efficiency may be achieved by use of a boundary layer by-pass or a system of vanes. In the case of a subsonic diffuser after a supersonic entry, a thick boundary layer results from the shock wave system and this, combined with the high Mach number after the normal shock wave, reduces considerably the optimum diffuser angle. Experimental evidence with a diffuser of $\theta = 6$ deg has shown that for $M = 0.67$ and $M = 0.98$, the respective pressure efficiencies were 99.5 and 93 per cent. Here the necessity of boundary layer control is clearly indicated.

Losses occurring in the combustor are divisible into two principle groups, namely, pressure losses and combustion losses. The former are due mostly to aerodynamic and thermodynamic effects, whilst the latter are due to chemical and physical conditions. It has been found that these losses are interchangeable, i.e., for a given weight or bulk of the combustor, a high combustion efficiency is achieved at the expense of a high pressure loss and vice versa.

Expansion Losses

On the subject of expansion losses, the report states that at subsonic flight speeds the expansion ratio in the propelling nozzle is always sub-critical; at supersonic speeds, however, depending on the magnitude of the internal losses, it may become super-critical. In a convergent nozzle when the critical pressure ratio is exceeded, critical conditions at the throat are established and stationary shock waves are initiated at the edges of the nozzle throat. For expansion pressure ratios up to the order of 4:1, the losses due to these shock waves are comparatively low. However, at higher expansion ratios the pressure distributions and shock waves have a peculiar form. The pressure losses due to these shock waves and from reflections at the jet boundaries, give rise to additional losses which increase with the expansion pressure ratio.

The mixing of the hot jet with the free stream has not, as yet, been thoroughly investigated. Tests on the V-2 rocket have shown that for mixing of the hot jet with a subsonic free stream, an increase in drag results as compared with that of the body without jet, although a small improvement at supersonic flight speeds may be realized.

End of Part I.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

THE ROLLS ACCIDENT

Tail Boom Breakage the Cause

WITH reference to your "Back to the Beginning" (*Flight*, October 28th), you say that the Hon. C. S. Rolls was killed when a modified elevator broke. The facts are that Rolls was flying a French-built Wright in a landing competition at Bournemouth in 1910. In a test flight he found that he could not come down over the grand stand sufficiently steeply to land on the mark. So overnight he increased the size of the elevator. Knowledge of stress was very small in those days, and the result was that when he gave considerable elevator, the increased area caused such a strain that the whole tail broke off. Keith Davies, who helped Rolls to make the modification, has recently confirmed the truth of that explanation.

London, S.W.3. GEOFFREY DORMAN.

EARLY FOKKER AIRCRAFT

A Richthofen D.VII Preserved

I WAS most interested in your recent article on the Fokker concern.

In view of this article I thought you might like to know that I still possess in my Museum Collection of Early Mechanical Transport Vehicles a Fokker D VII built during January, 1918. This machine is in original condition and I found it near Versailles prior to the war (except for fabric).

After making very extensive enquiries I was only able to trace one further example, but this had been considerably altered and was actually used in the film "Hell's Angels." The German authorities had no knowledge of a D VII although they had two Triplanes built for a film. I will be most interested to hear of any further information as regards the D VII type.

The machine I possess was used in Jagdstaffel 71 and the Richthofen Squadron and according to the German authorities carried large skull and crossbones on both sides of the fuselage, which was black, the remainder being vermilion and white.

Weybridge, Surrey. R. G. J. NASH.

THE FASTER THE HOTTER

But Density Comes into the Picture

EXAMINATION of the graph reproduced on p. 548 of *Flight* of November 4th shows that the ram temperature rise is given as the square of the speed (not the speed) divided by 5,650. On this assumption the aircraft proposed by your correspondent, Mr. L. E. Baynes, for inverted flight at 25,000 m.p.h., would experience a temperature rise of about 110,000 deg. F. Even a modest V.2 would probably melt. However, there is little basis for the assumption, since the temperature rise depends on the air density, and diminishes with increase in altitude, while high fineness ratios should help considerably.

How fortunate! Yet no more so than the very presence of an atmosphere which contains oxygen, carries rain across the continents, maintains an adequate ground temperature, reflects radio waves, shields us from cosmic radiation, and, of course, supports aircraft. Is this also due to long-term planning? I venture to suggest the reading of *Creation Revealed in Six Days*, by A. Cdre. P. J. Wiseman (published by Marshall, Morgan and Scott).

The American Standard Army Summer Day temperature scale is seen from the graph to assume a sea level temperature of 100 deg. F., and a lapse rate of 3.6 deg. F. per 1,000ft., within the troposphere. G. R. BARRATT.

Manchester, 19.

ALTIMETER SETTINGS

Importance of Static Position Error

WHILST in full agreement with the points raised in Mr. J. C. Neilan's letter (October 14th) regarding altimeter errors and their possible contribution to flying accidents, I would like to add, however, that he has apparently omitted on major possible error. I refer of course to the static position error.

Although AP.2095, Pilot's Notes, General, Part I, Chap. V, Para. IV, explains in some detail the causes and magnitude of these errors, it is clear that pilots in general do not appreciate this point. As a rule, P.E.C. is considered in relation to I.A.S. and not to altitude. However, to quote from the above publication:

"At sea level at 200 knots the altimeter error is approximately 18 times the A.S.I. error in knots, whilst at sea level at 300 knots the error increases to 30 times the A.S.I. error in knots." i.e., P.E.C. 2 knots = Altimeter error 36ft and 60ft respectively."

Secondly, it must be understood that the P.E.C. varies considerably with height. To quote from our own experience; at 200 knots the increase in altimeter error from sea level to 10,000ft is 40 per cent and from sea level to 20,000ft is 100 per cent. This being quite apart from any increase of instrument error with height.

In Pilot's Notes, for particular aircraft the only mention generally made to the P.E.C. relation to altitude is in the section dealing with blind approach. Here it points out that the error exists, and suggests a suitable adjustment be made to the barometric setting of the altimeter. In fact when an aircraft is executing a blind approach, the prevailing conditions, flaps down, undercarriage down and low speed, all tend to produce a large static position error, therefore a large altimeter error.

If the above is applied to the cases quoted in Mr. Neilan's letter, it will be seen that a very real danger of collision exists if aircraft, especially of different types, are to be stacked at 500ft intervals. Opinions as to how allowances might be made for these errors either by aircrews or ground controllers are probably diverse and might prove interesting.

Alton, Hants. W. S. WORNER.

CLIPPED WINGS

A German View

GERMAN pilots know that the war is lost for the German people. But there is something which they do not understand; for instance, that with "The End" all other things must be lost which have nothing to do with the war. The Control Council for Germany decrees, by directive No. 23, the limitation and demilitarization of sport in Germany. Flying also comes under this regulation. Is that just? We know the objection which may be made: Gliding and soaring is a schooling for war-flying.

We do not dispute this objection in the most comprehensive sense, but we do ask: "Is not also a walking-tour good training for future soldiers?" Is not also sailing able to produce good personnel for a navy, able to understand the sea? The objection does not apply. We have always thought that the English would be sportsmen. And cannot the English pilots feel with us?

Where are the comrades who used to fly with us in amicable emulation in the Rhön? We call to our sportsmen friends from across the water. We seek your understanding, nothing else! HANS-JOACHIM KOWSKY.

Muenster, Germany.

SKID UNDERCARRIAGES

German Experience Not Encouraging

WHILE reading *Flight* for November 4th, 1948, I came across a passage in S/L. King's lecture "Some Considerations Affecting Design, Part I, Fighters," in which he says "The wartime Me 163 demonstrated the possibilities latent in jettisonable wheels and a landing skid." He continues by giving a list of desirable features attendant on this scheme. However, both sides of the picture are not presented.

Following experience with the Me 163 in operations, the Germans considered the skid undercarriage to be a bad design feature, and on the Junkers development of the Me 163, the skid was replaced by a retractable tricycle undercarriage.

The reasons behind the German decision were as follows:—

(a) Landing on the skid subjected the pilots to a bit of very nasty horizontal G.

(b) The front of the skid often broke away, damage to the aircraft resulting.

(c) Ground handling of the aircraft after landing was very difficult.

The first two faults can, perhaps, be dismissed by saying that a little research into the matter would have soon rectified things; however, the third point is inescapably true.

Handling of the Me 163 after landing was accomplished with

Correspondence . . . . .

a self propelled trolley which lifted the aircraft clear of the ground by means of two hydraulically operated arms, it then being possible to transport the aircraft back to the hangars. Utilization of the airfields was much restricted by this performance, and it seems highly unlikely, in view of the fact that maximum operational efficiency of an airfield is an all-important factor in warfare, that the skid will be used, except for very special applications.

Being a very keen student of the German Air Force, I maintain that very much can be learnt about future aerial combats by studying German experience with jet aircraft. There is little doubt that we must learn by their mistakes, at the same time giving proper credit for their magnificent technical developments.

ADRIAN P. BISHOP.

R.A.E., Farnborough,
Hants.

THE TWO FURIES

Unfortunate Duplication of Nomenclature

THAT confusion in the nomenclature of service aircraft can lead to serious difficulties was surely made clear during the war. It was, I believe, the U.S. Navy which took the initiative in standardizing code names for Japanese aircraft, thereby facilitating recognition and reporting. Now this same service has adopted for one of its standard deck-landing fighters the name "Fury," inviting confusion with an aircraft of the same class in regular service with the Royal Navy.

Surely the dangers of such duplication are evident. One visualizes some embarrassing—even dangerous—situations which might arise if British and American aircraft carriers were ever called upon to operate as a combined task force.

Though many of the most appropriate names have already been allocated to British fighters, an abundance remains. This was made clear in the correspondence columns of *Flight* when the Supermarine jet fighter was dubbed the "Attacker."

Whipsnade. JOHN ELLIOT

PEMBERTON BILLING

WITH the death, at the age of 68, of Noel Pemberton Billing is severed one of the most colourful links with the early days of British aviation. By nature a stormy petrel, "P. B." was often in the public eye, frequently in connection with subjects which had nothing to do with aviation.

He was an early experimenter in flying, and in 1908 had an airfield at Fambridge, where he also built some machines. It is, however, as the founder of the Supermarine Aviation Works that we like to remember him. In 1912-13 he was building and scheming flying boats, and it was he who coined the name Supermarine for aircraft which operated from and flew over the sea. His first flying boat, the P.B.I., had the Linton Hope type of circular hull, with built-on step. It was not a success, largely due to being under-powered, but it laid the foundation for the later very successful Southampton flying boats built after the Supermarine concern was taken over by Commander James Bird and Mr. Hubert Scott-Paine.

Not content with being a designer, he decided to become a pilot, and before the first war he had a bet with Mr. (now Sir Frederick) Handley Page as to who would get his "ticket" first. No one would teach him, and so he bought a machine and managed to get his certificate at Brooklands, although his solo performance was somewhat alarming. "H. P." was learning at the same time at Hendon, using the little H.P. monoplane which became known as "The Yellow Peril." Pemberton Billing beat him to it, and Handley Page gave up the attempt.

For a time "P. B." was in the Royal Naval Air Service, but he relinquished his commission in order to enter Parliament as Member for East Hertfordshire. During the first world war he strongly criticized in the House the Air Ministry for sending pilots of the R.F.C. over the lines in B.E.2Cs, the "Murder Charge" being the subject of an investigation.

Although he had innumerable other interests, Pemberton Billing could not keep away from aviation, and it may be recollected that some years ago we published an article by him on his "slip-wing" scheme. That was really a revival, in a different form and for a different purpose, of an idea he had in 1912 or 13. One of his flying-boat sketch designs was so arranged that if the machine was brought down by engine failure the wings and engines could be floated away, leaving the hull to be propelled by an ordinary boat engine and water propeller.

And now "P B." has found the peace which he never attained, nor desired, during his life.

H. G. BRACKLEY

JUST as we were closing for press, the sad news was received of the death by drowning of Air Commodore H. G. Brackley at Rio de Janeiro. He was on a tour of British South American Airways stations and apparently got into difficulties when swimming off Capacabana beach. An obituary notice will appear next week.

BACK IN AVIATION

HIS many friends in the aircraft industry will be glad to learn that Mr. L. G. Frise has been appointed chief engineer to Percival Aircraft, Ltd. He took up his new duties on November 15th.

Leslie Frise became assistant designer to the late Capt. Barnwell during the first world war, and, in course of time, chief designer. Since he left the Bristol Aeroplane Company some years ago, he has had many tempting offers from "outside," but it is a good thing for British aviation that he resisted them all, and that his long experience is now to be made use of.

We are informed by Mr. A. A. Bage that he is resigning his post as chief designer, owing to a disagreement on policy. Since he joined the firm in 1934 he has been responsible for the design of all the Percival aircraft types produced during the period.

BOOKS RECEIVED

Theoretical Aerodynamics, by L. M. Milne-Thomson. Macmillan & Co., 40s.

An Introduction to Aerodynamic Compressibility, by J. Black. Bunhill Publications, Ltd., 18s.

Weather Forecasting, by S. W. C. Pack. Longmans, Green & Co., 25s.

Essential Metallurgy for Engineers, by Archibald Comley Vivian. Sir Isaac Pitman & Sons, Ltd., 12s 6d.

The Book of Flying, edited by Carlton Wallace. Evans Brothers, Ltd., 12s 6d.

A Picture of the Universe, by Sir Harold Spencer-Jones. Raven Books, Ltd., 3s.

Radio Aids to Navigation, by R. A. Smith. Cambridge University Press, 9s.

Air Power Can Disarm, by J. M. Spaight, C.B., C.B.E., Sir Isaac Pitman & Sons, Ltd., 10s 6d.

Airliners and Airways of To-day, by S. E. Veale. The Pilot Press, Ltd., 21s.

Fundamentals of Vibration Study, by R. G. Manley. Chapman & Hall, Ltd., 15s.

Atomic Energy, a Discussion by a Chatham House Study Group. Royal Institute of International Affairs, 4s.

The Night Sky, by J. G. Porter. Winchester Publications, Ltd., 5s.

Magnesium—Its Production and Use, by Ernest V. Pannell. Sir Isaac Pitman & Sons, Ltd., 25s.

Mathematical Theory of Rocket Flight, by J. Barkley Rosser, Robert R. Newton and George L. Gross. McGraw-Hill Publishing Co., Ltd., 22s 6d.

Technical Aerodynamics, by Karl D. Wood. McGraw-Hill Publishing Co., Ltd., 33s.

Applied D. R. Navigation and Flight Planning, by J. H. Clough-Smith. Sir Isaac Pitman & Sons, Ltd., 22s 6d.

Airline Traffic and Operations, by Morris B. Baker. McGraw-Hill Publishing Co., Ltd., $4.50.

Aircraft Electrical Engineering, by F. G. Spreadbury. Sir Isaac Pitman & Sons, Ltd., 30s.

Aircraft Development and Production, edited by M. M. Williamson and G/C. G. W. Williamson. Paul Elek Publishers, Ltd., 30s.

How to Draw 'Planes, by Frank A. A. Wootton. The Studio Ltd., 3s.

Model Sailplane Design, by P. R. Payne. Percival Marshall & Co., Ltd., 3s.

The Analytical Development of Curves and Streamline Shapes, by Harry H. Haase. Deemar Company, $4.50.

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements

AUTUMN AIR: This seasonable scene was recorded by a "Flight" photographer during a recent week-end at West Malling, while Meteor 3s of No. 500 (County of Kent) Squadron, R.Aux. A.F., were refuelled after a late afternoon operation. Although, as in other Auxiliary Squadrons, "500's" groundcrews are still below strength, their zeal has contributed a great deal towards the unit's recent average of 150 flying hours per month.

R.A.F. Appointments

WITH effect from December 1st, A.V-M. T. C. Traill, C.B., O.B.E., D.F.C. is to be Air Officer in Charge of Administration, Maintenance Command. Since May, 1946 A.V-M. Traill has been A.O.C. No. 12 Group, Fighter Command. His successor at No. 12 Group is A. Cdre. G. Harcourt-Smith, C.B., C.B.E., M.V.O., who has been Director of Organization at the Air Ministry since April, 1946.

Two recent appointments to the Headquarters of the B.A.F.O., Germany, are those of A. Cdre. F. E. Vernon, C.B., O.B.E., as Senior Technical Staff Officer, and A. Cdre. C. J. Luce, D.S.O., as Command Defence Officer. A. Cdre. Vernon has been S.A.S.O. of Technical Training Command since June 1946, while A. Cdre. Luce, who was an Army officer until receiving a permanent commission in the R.A.F. Regiment last June, commanded the R.A.F. Levies, Iraq, for nearly three years. Also announced is the appointment, as Commanding Officer of R.A.F. St. Athan, of A. Cdre. H. E. Forrow, C.B., O.B.E., who has commanded the R.A.F. station at Henlow since October, 1946.

V.R. Training at Perth

THE members of No. 103 R.A.F. Volunteer Reserve Centre, Perth, and No. 11 Reserve Flying School, Scone, are drawn from a very wide area. On one recent Saturday, there were present men from as far away as Inverness, Aberdeen, Fort William and Prestwick, while there are others whose homes are in the Hebrides and who utilize air transport to the mainland to put in their hours on the Tigers at Scone. This keen spirit has enabled the Flying School to put up a remarkable record of flying hours for its size; at present 120 pilots are in training, as well as 20 navigators and 20 signallers. Another 100 aircrew are in various stages of entry. Since May 1st, 1947, when the School opened, the pilots have put in more than 6,000 flying hours, including 350 hours of night flying. The School began training navigators and signallers on June 1st this year, and its Ansons have now done more than 350 hours. Since the recent opening of the R.A.F.V.R. to ground trades, 12 officers, 20 airmen and four airwomen have applied to join.

The Centre will shortly be signing on Scotland's third W.A.A.F.V.R. pilot—Miss Clarice Brook, of Glasgow. Unlike the two previously signed, who were ex-A.T.A. pilots, Miss Brook had never flown except as a passenger until a year ago when she applied to join the V.R. Told that she must have a minimum of 100 hours solo, she promptly joined the Strathtay Flying Club; and now, at a cost of something like £400, she has qualified with 42 hours' dual and 107 hours' solo flying in her log-book, and holds her "A" licence.

Naval "A" Branch Abolished

A STATEMENT was issued by the Admiralty on Thursday, November 11th, announcing that the (A) Branch of the Royal Navy is to be abolished and that the officers now serving in this Branch shall be transferred, as appropriate, to the Executive or Engineering Branches. This indicates, continues the Navy statement, that the Admiralty is pursuing the policy on which it embarked two years ago when the style and name of the Fleet Air Arm was changed to that of Naval Aviation, by making all those concerned with aviation within the Fleet an integral part of the Navy. It will also mean that the letter "A" which is inside the gold lace curl of so many present Naval officers concerned with aviation, will disappear.

Today approximately one-third of the personnel of the Navy is directly or indirectly concerned with aviation but those officers in the (A) category are not on equal terms with the general Executive Branch as regards future executive command. Under the new scheme they may qualify to rise to the highest ranks in the Navy, but it is recognized that some, who will in future be borne on the general lists of the Executive and Engineering Branches, may not be qualified, through past lack of seamen-like experience, for the full range of appointments open to the executive officer. Details of the qualifications necessary in order to be eligible for all appointments will be announced later. Meanwhile, it is announced, 100 permanent commissions will be granted before the end of this year, to selected officers now serving on extended service (A) commissions, and further permanent commissions will be granted up to a proportion of 15 per cent of those officers who volunteer for a further period of service, these latter commissions being given towards the expiration of their engagements.

C.A.S. Visits Ulster

"THE R.A.F. needs an influx of men with brains, skilled hands, and guts," said Marshal of the R.A.F. Lord Tedder in the course of a short speech at Belfast, during a three-day visit to Northern Ireland from November 6th to 9th. Lord Tedder, who was accompanied

by Lady Tedder, was received at Aldergrove by the A.O.C. Northern Ireland, A. Cdre. B. V. Reynolds, and the visitors were guests of the Governor of N. Ireland, Earl Granville, at Government House. On Sunday, November 7th, the C.A.S. visited Nos. 502 and 2502 Squadrons of the R.Aux.A.F., and later took the salute in Belfast at the Remembrance Day parade by 1,650 ex-Servicemen.

Unclaimed Awards

OF 1,375,000 wartime members of the R.A.F. entitled to campaign stars and war medals, only about 21 per cent have so far claimed them, states the Air Ministry. Recent applications have averaged only about 4,000 a week, and application cards are to be withdrawn from Post Offices on November 30th. Medals are usually dispatched within a fortnight of the cards being received, although delays are sometimes caused when an individual's entitlement has to be checked with his original records.

New Officers' Dress Rules

BATTLE DRESS, to be known in future as No. 2 (Home) Dress, has now become standard R.A.F. officers' uniform for all other than ceremonial and special occasions, when No. 1 (Home) Dress will be worn. Officers who still possess the old pattern service uniform may continue to wear it as a substitute for No. 1 or No. 2 Dress. Formal Mess Dress will consist of No. 1 Dress with a black bow tie, soft white shirt, and wing collar; the pre-war pattern Mess Dress may be worn by officers who still possess it, although it cannot yet be bought.

R.C.A.F. Auxiliaries

THE Royal Canadian Air Force has announced a one-year Service training plan to provide pilots for Canadian auxiliary squadrons. Selected members of the squadrons will undergo medical examinations and a course in Service procedure at the R.C.A.F. School of Aviation Medicine in Toronto, and then be posted to the Flying Training School at Centralia, Ontario, for a year's flying instruction. Successful completion of the course will be rewarded by pilot's wings and the rank of flying officer. Members then return to civilian life and carry on with further training on the operational aircraft available at their auxiliary units. They will rank as aircrew cadets during the course, but will receive officers' rates of pay.

Seventeen auxiliary airmen have already been selected under this plan and will begin training shortly.

The possibilities of a similar scheme for ground training of fitters, riggers, metal workers, meteorologists, clerks, and photographers, are being investigated at Air Force H.Q., though such courses would probably occupy a shorter period than the pilot training.

£50,000 for Benevolent Fund

SURPLUS money totalling £50,000, which was subscribed for the Battle of Britain Memorial Chapel in Westminster Abbey, has been handed over to the R.A.F. Benevolent Fund.

R.A.F. Flying Club

REDUCED rates are now offered to members of the R.A.F. Flying Club who pay for periods of five hours or more flying time in advance. Bonuses of free flying time are also given to members who fly for more than a certain number of hours in any one year. The basic rate of £2 an hour is reduced on a sliding scale from £1 19s an hour for five hours, to £1 16s an hour for 30 hours. Thus a member who pays in advance for 30 hours saves £6. The bonus system, which applies to all members whether or not they purchase block flying time in advance, earns half-an-hour's free flying time after 10 hours, rising to three hours' free flying time after 30 hours.

Membership of the club, which has its headquarters at Panshanger, Herts, and a branch at Wolverhampton, is open to past and present Air Force officers; N.C.O.s may become associate members. The club provides wider flying facilities than are available with Service aircraft, such as the carrying of civilian passengers and private overseas touring. It has Moth Minor and Auster aircraft, and if there is sufficient demand, branches may be opened in other parts of the country.

NORTHOLT GREETINGS: The Secretary of State for Air, Mr. Arthur Henderson, meets the crew of the York in which he flew to Germany last week for an inspection of the air-lift.

Mosquito Manufacture

THE new de Havilland factory at Broughton, Chester, which was taken over by the firm in June, recently produced its first aircraft, a Mosquito 38 night-fighter. Mr. Pat Fillingham, chief production test pilot for D.H., made the first flight from the adjacent R.A.F.-controlled airfield. The factory was built by the Government for war production, and until last March was operated by Vickers-Armstrongs.

R.A.F. Boxing

NO fewer than 142 bouts were fought in the senior R.A.F. station annual boxing competition for the Lord Wake-

NEW AIR-LIFT BASE: A French guard of honour and military band greeted the first aircraft—a Skymaster—to arrive at the new air-lift terminal at Tegel, in the French Zone of Berlin.

Service Aviation . . . . .

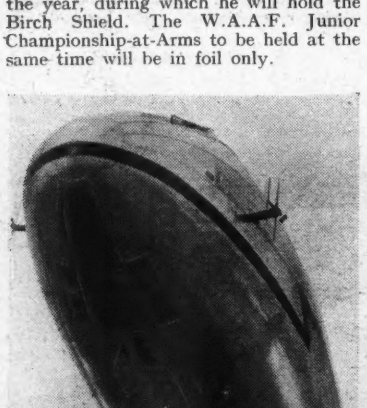
field trophy, held at R.A.F. Station, Cosford, on November 1st, 2nd and 3rd, a record entry of 23 teams involving the use of three rings on two and a half days. Thirteen stations were represented in the finals, of which Kirkham, St. Athan, and Cardington finished with 36 points each, Cosford (last year's winners) following closely with 32. Kirkham were declared the winners by virtue of the fact that they had the greatest number of winning finalists. The competition for the "junior"—with a strength of less than 500—station Wakefield Trophy, held at Upper Heyford on October 26th and 27th, was won by R.A.F. Station, Spitalgate, and the competition for the officers' Wakefield Trophy, held at the same time, was won by R.A.F. Station, Boscombe Down.

Squash Rackets Championship

BOTH the R.A.F. and W.A.A.F. championship holders retained their titles when the finals of the squash rackets contest were held at the Landsdowne Club on Saturday, November 6th. S/L. D. S. Pain beat F/O. L. J. Waugh by 9-7, 9-5, 8-10, 9-6; and in the W.A.A.F. contests Flt/O. N. R. Fernihough repeated her 1947 success when she beat Flt/O. J. M. Pawson by 5-9, 6-9, 9-1 retired. The runner-up was unluckily hit in the eye by a ball during the second game and the referee later stopped play.

R.A.F. Fencing Contest

THE novices' fencing competition for the R.A.F. Junior Championship-at-Arms will be held at the School of Physical Training, Cosford, on November 22nd and 23rd. The competition will be in all weapons—foil, epee, sabre and bayonet—and the competitor gaining the highest aggregate score will be known as the R.A.F. Junior Champion-at-Arms for the year, during which he will hold the Birch Shield. The W.A.A.F. Junior Championship-at-Arms to be held at the same time will be in foil only.



"Flight" photograph.

AIMING AID: Production Hastings now feature this glazed panel below the nose to facilitate accurate supply-dropping.

PUPIL PILOTS: The cheery group above—L. to R., Cadet Pilots Murrells, Hayward, Smith, Shelley, and Kerr—are the first ex-members of the A.T.C. to have made solo flights under the scheme providing for aircrew training during the National Service period, and continuation of training in the R.A.F.V.R. or R.Aux.A.F. after demobilization. They are being trained at No. 7 F.T.S., Cottesmore.

Auxiliary Appointment

A FORMER pilot of No. 602 (City of Glasgow) Squadron, W/C. A. M. Grant, has been appointed to command No. 3510 (Inverness and District) Fighter Control Unit, R.Aux.A.F. W/C. Grant joined the Auxiliary Air Force in 1932, and travelled to Glasgow from Inverness each week-end to train; it was as a "602" pilot that he took part in the first air battle over Britain of the war—over the Firth of Forth on October 16th, 1939; W/C. C. H. MacLean, who also fought in the encounter, is now C.O. of the Glasgow Fighter Control Unit.

Permanent Commissions

GENERAL DUTIES BRANCH

Squadron Leaders: H. A. England, D.F.C., A. K. Grayson, R. Hewitt, A.F.C., J. A. Lee-Evans, D.F.C., P. E. Lewis, D.F.C., T. W. Newberry, C. D. Owen, D.F.C., G. Vivian, P. C. Webb, D.F.C.

Flight Lieutenants: H. Adamson, A. F. Boyd, D.F.C., O. V. Brooks, D.F.C., R. L. Cameron, R. M. Chatfield, D.F.C., L. E. Cegan, S. F. Cooper, A.F.C., K. S. Delbridge, D.F.C., L. Dolphin, A. C. Douglass, H. E. Durell, S. Evans, D. Fowkes, C. M. Graham, B. J. L. Greenland, D. I. Griffiths, D.F.C., H. R. Harries, A.F.C., J. S. Knox, D.F.C., A. L. Law, D.F.C., R. Leggett, J. M. Lennox, D.F.C., J. H. Lewis, R. A. N. McCready, W. McFetridge, W. E. Martin, D.F.C., J. W. Patrick, E. H. E. Perry, R. Pollitt, L. W. Quick, D.F.C., A. Rawling, H. K. Rees, F. Reid, K. Sellars, K. W. Simpson, E. Sleeman, A. C. Southward, F. W. Wincott, R. Wood, D.F.C.

Flying Officers: G. R. Baxter, M. F. Crow, C. F. Gillan, D. W. Grubb, N. W. L. Linton, D. J. Mitchell.

TECHNICAL BRANCH

Squadron Leaders: E. L. D. Bickenson, D.F.C., W. Cunliffe, O.B.E., E. T. Wilcox.

Flight Lieutenants: R. L. Armstrong, D. L. R. Bird, A. E. Burgess, K. P. Cater, J. J. Clancy, J. R. Clapham, W. R. F. Cooney, F. Cotterill, F. A. E. Cramp, L. E. Davies, N. English, W. G. Facey, W. J. M. Gatehouse, H. S. Hallett, G. Hickmott, H. Holme, M.B.E., N. E. Hore, W. T. Jackson, I. N. Jones, B.E.M., E. Kerrigan, R. J. King, G. E. McCullagh, R. I. Manning, D.F.C., H. A. J. Mills, W. T. Morrison, A.F.C., G. Oversby, H. T. Pascoe, R. A. Ruane, A.F.M., K. J. Smedley, F. L. Wherry, C. F. Whitelock, A. S. Wickens, D.F.C., W. Wilkinson.

Flying Officers: H. W. Cayter, N. E. Guest, D. H. Hale, D. A. R. Naylor, B.E.M., W. Stevens.

SECRETARIAL BRANCH

Wing Commander: J. B. T. Whitehead.

Squadron Leaders: H. J. L. Hallowes, D.F.C., D.F.M., W. F. Howe, N. J. C. Pollock, A. C. Smith, A. H. Webster, D.F.M.

Flight Lieutenants: A. D. Bain, K. C. A. Ball, D.F.M., C. M. Bowring, D.F.M., H. K. Carrol, A. W. Dawson, F. G. Drew, A. Dunning, D.F.C., E. Elliot, K. Gamble, R. Glew, C. H. Godfrey, W. H. Goldstraw, D.F.C., G. G. Graham, D.F.M., L. R. Healey, D.F.C., D.F.M., L. W. Hewett, D. F. Hodge, D.F.C., H. B. Hogg, H. Leigh, W. F. Lloyd, S. C. W. Lock, D.F.C., C. T. Lynas, N. G. Payne, D.F.C., J. A. Pritchard, E. Richardson, D.F.C., A. W. Scott, J. T. Seeley, W. S. Tagg, D. F. Wilson, P. H. Worzencraft, F. S. Wright.

Flying Officers: J. W. R. Alexander, A. E. Bell, J. W. Birch, W. H. P. Blee, J. Buckley, J. L. Clarke, H. W. Crook, D.F.C., A. E. Gregory, J. V. J. Gwinn, R. P. Hand, J. R. Howorth, G. E. Moss, E. J. A. Patterson, H. Renshaw, R. C. K. Smith, D. W. Southwell, R. C. Thornton, R. B. Walker, A. H. Wood, D.F.C., A. T. Wright.

Pilot Officers: C. H. Lister, H. Fox, T. E. S. Hunt.

EQUIPMENT BRANCH

Squadron Leaders: C. Billington, C. E. A. Pollock.

Flight Lieutenants: H. Ireland, A. G. Wright, D.S.C.

Flying Officers: J. F. Cowley, M. G. Dyer, J. A. Fitzgerald, A. Hale, B.E.M., G. A. Jeffery, F. McGonigle, A. J. Moore, H. C. Trent.

Pilot Officer: J. W. McConnel.

R.A.F. REGIMENT

Squadron Leaders: W. A. P. Gardner, S. C. E. Norris.

Flight Lieutenant: E. C. Heath.

Flying Officer: R. G. M. Hubbard.

Pilot Officer: J. S. A. Brant.

MARINE BRANCH

Squadron Leaders: E. W. T. Hardie, J. D. Loughman, R. D. W. Mackay, E. H. Roberts, M.B.E.

Flight Lieutenants: A. T. C. Copper, H. F. G. Dainty, D. M. B. Fitzgerald-Lombard, J. T. C. Hillman.

Flying Officer: C. J. Lawrence, O.B.E.

PHYSICAL FITNESS BRANCH

Flight Lieutenant: F. C. S. Jones.

Flying Officer: W. H. Ogden.

AIRCRAFT CONTROL BRANCH

Squadron Leaders: J. G. Barr, A. T. H. Willis.

Flight Lieutenants: E. J. E. Bedwell, R. H. J. Brailsford, R. L. Collins, E. J. Hale, D.F.C., A.F.C., J. B. Hewitson, N. E. O. Lilley, D.F.C., D. W. K. Miles, A.F.C., E. T. Mullaley, J. Oliver, D.F.C., D.F.M., W. J. T. Smith, A.F.C., T. S. Steuart, A. H. Tompkins, A.F.C.

Flying Officers: J. Duffy, D.F.M., G. G. Palmer, R. Wynzar.

MEDICAL BRANCH

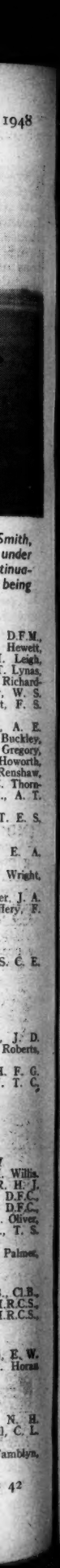
Flight Lieutenants: W. A. Crawford, M.B., Ch.B., P. R. Travers, M.B., B.Sc. (Lond.), M.R.C.S., L.R.C.P., J. A. Wheeler-Bennett, M.R.C.S., L.R.C.P.

CHAPLAINS BRANCH

The Reverends: J. P. Cooper (C. of E.), E. W. Daly (R.C.), W. P. Henry (R.C.), T. R. Horas (C. of E.), E. N. Phair (C. of E.).

CATERING BRANCH

Squadron Leader: A. F. Howgate.

Flight Lieutenants: A. D. Deadman, N. H. Gosden, W. M. G. Gosden, A. A. Lamprell, C. L. Moyes.

Flying Officers: R. H. Powell, W. R. Tamblyn, R. A. G. Thomson.